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Introduction

The World Journal of Medical Education and Research (WJMER) (ISSN 2052-1715) is an online publication of the Doctors Academy Group of Educational Establishments. Published on a quarterly basis, the aim of the journal is to promote academia and research amongst members of the multi-disciplinary healthcare team including doctors, dentists, scientists, and students of these specialties from around the world. The principal objective of this journal is to encourage the aforementioned, from developing countries in particular, to publish their work. The journal intends to promote the healthy transfer of knowledge, opinions and expertise between those who have the benefit of cutting edge technology and those who need to innovate within their resource constraints. It is our hope that this will help to develop medical knowledge and to provide optimal clinical care in different settings. We envisage an incessant stream of information flowing along the channels that WJMER will create and that a surfeit of ideas will be gleaned from this process. We look forward to sharing these experiences with our readers in our editions. We are honoured to welcome you to WJMER.

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A WELCOME MESSAGE FROM THE EDITORS

It is with great pleasure that we bring you the twenty-eighth edition of the World Journal of Medical Education and Research (WJMER), which includes a number of interesting articles from across the globe.

The opening article by Baig et al. discusses maximising operative training opportunities for non-training grade doctors in neurosurgery. The article highlights steps that would hopefully allow SHO doctors with an interest in neurosurgery to scrub into surgeries.

In the following article, Sharma explores the value of cadaveric dissection in medical schools and examines its place in contemporary undergraduate medical education. She concludes that methods such as computer-assisted learning and techniques such as plastination are important for all undergraduate students, whilst selective cadaveric dissection should be reserved for those who will benefit the most from the tactile experience.

Mabeya *et al.* study the barriers to HPV vaccination and cervical cancer prevention at the health personnel level during the COVID-19 pandemic in Eldoret, Kenya. The study concludes that significant divergent knowledge among workers on HPV may limit HPV vaccine uptake or target the wrong age group.

Recognising that mobile phones can be used to promote learning, Rajaratnam assesses the attitudes of healthcare professionals towards the use of mobile technology to enhance learning in Singapore. The study found that, while individuals accept mobile learning, it is less popular in the context of professional education.

Tolson *et al*. review the bedside transthoracic echocardiogram results of all patients admitted to Croydon's Intensive Care Unit during the first wave of the COVID-19 pandemic (March to May 2020). Based on their findings, they suggest that intensivists managing coronavirus patients should obtain prompt echocardiograms to help identify right-sided dysfunction early and tailor their management appropriately.

Jamil et al. explore the perceptions of medical trainees towards the formal learning modalities used during the COVID pandemic. They found that face-to-face teaching was the preferred choice of learning modality in a District General Hospital, despite the numerous virtual opportunities that exist today.

This edition concludes with a 'Letter to the Editor' in which Tweedie expresses his opinion on an article published in Volume 26 of WJMER. The article discussed burnout in the wake of the COVID-19 pandemic in healthcare systems across the globe. He suggests interventions that could help to tackle this issue.

We sincerely hope that you find these articles engaging, intellectually-stimulating, and enjoyable to read.

Ms Karen Au-Yeung
Associate Editor

Dr Rebecca Williams
Associate Editor

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World Journal of Medical Education and Research:
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Maximising Operative Training Opportunities for Non-Training Grade Doctors in Neurosurgery

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Abstract
Neurosurgery is an extremely competitive specialty to enter in the United Kingdom, and a successful application to the run-through training from Specialty Training (ST) 1 requires the demonstration of a good understanding of the day-to-day neurosurgical practice, in addition to theoretical knowledge and other qualities. There is a limited number of Foundation Year (FY) 2 rotations in Neurosurgery nationally. As a result, many aspiring neurosurgeons opt to take up a 'non-training grade' position at the Senior House Office (SHO) level in an NHS Neurosurgical Department. Generally, the operative cases are designated to the registrars, but there are sometimes opportunities for SHO doctors to be involved. In this article, we aim to highlight key work habits that promote productivity and thereby increase the possibility of scrubbing into surgeries as an SHO. This would also apply to any other surgical specialties outside Neurosurgery.

Key Words
Medical Education; Neurosurgery; Non-Training Grade; Specialty Training; Surgical Training

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Introduction

Neurosurgery is an extremely competitive specialty to enter in the United Kingdom, and a successful application to the run-through training from Specialty Training (ST) 1 requires the demonstration of a good understanding of the day-to-day neurosurgical practice, in addition to theoretical knowledge and other qualities.[1] There is a limited number of Foundation Year (FY) 2 rotations in Neurosurgery nationally. As a result, many aspiring neurosurgeons opt to take up a 'non-training grade' position in an NHS Neurosurgical Department. In these positions, doctors can gain further insight into the specialty and exposure to surgeries amongst other clinical activities, which can help their long-term career planning. Usually, this is a Senior House Officer (SHO) level post in which the daily responsibilities include handover from the night team, generating clinical and non-clinical tasks ('jobs') from the ward round, clerking new patients of both emergency and elective admissions, and attending to medical and surgical emergencies on the ward. The SHO would then go on to complete these jobs whilst the specialty registrar and consultant operate or attend clinics. Generally, the operative cases/lists are designated to the registrars, but there are sometimes opportunities for SHO doctors to be involved. This is primarily important so that doctors can understand the logistics of preparing cases, assist with perioperative care, and consolidate their technical learning from cadaver and simulation courses.[2] However, with the increasing complexity and intensity of managing neurosurgical inpatients, it is getting more difficult to find time during the normal SHO working shift for scrubbing into theatre. The recommendations in this article would also apply to any other surgical specialties outside Neurosurgery.

How to Maximise Opportunities to Scrub

Challenges

As they are not routinely rostered into theatre, SHOs often stay behind and work beyond contracted hours or return to the hospital on the weekends for an opportunity to scrub. This can directly impact social commitments and overall work-life balance, especially if there is no pressure to reach operative case number targets.

Recommendations/Action

Nevertheless, there are ways to maximise opportunities to scrub:

Efficient Handover and Ward Round: Having a handover and ward round that is clear, informative and focused is essential in the everyday functioning of the Neurosurgical ward. A succinct job list is not

only clearer; it also aids communication.

Prioritisation: A prioritised jobs list is important to complete the tasks efficiently in the appropriate time frame[3], thereby increasing productivity and time for surgeries.

Delegate Jobs Amongst the Team: Working in a team where tasks are split between the doctors and nurse specialists is rewarding. Prioritise the jobs and complete them to maximise time for theatre.

Anticipate Tomorrow's Tasks: Prepare discharge medications and letters for the patients that will be discharged the day after. Likewise, prepare blood forms/requests and imaging requests early in the day and in advance for the next day. This will reduce the number of jobs for the next day and increase the chances to scrub.

Introduce Yourself to the Patient/Family: It is invaluable to introduce yourself to the patient/family if you are going to be involved in the operation. Make an active effort to be present during the consenting process as this can facilitate learning and gain a level of trust from the patient/family. Ultimately, consultants are happier knowing that you were involved at all levels of the patient journey rather than just looking for an opportunity to scrub in.

Pre-operative Bloods and Cannulation: Always try to get pre-operative bloods and cannulation done yourself as this will give you a chance to introduce yourself to the patient and/or family if you have not done so yet. It also establishes a collaborative working relationship with the anaesthetic and theatre team, who will be more understanding when you join theatre halfway through a case.

Discussion of the Case with a Senior: Discussion of the surgical steps of a case not only enhances the learning of a practical skill, i.e., operating through the Kolb cycle[4], but it also identifies stage(s) of the surgery which is/are most appropriate for the SHO's stage of training if he/she can only participate for a limited time of a long operation.

Conclusion

Scrubbing into surgery is a great educational experience for clinicians in training and non-training positions. Neurosurgery patients need comprehensive medical care usually delivered on the ward by SHO doctors. Overall, the main responsibilities of the SHO should be attended to and, if done effectively and consistently, can pave the road to scrubbing into surgeries. We recommended some simple steps in maximising theatre experience as an SHO.

References

1. NHS Medical, Dental Recruitment, Selection, Competition ratios, Available from https://specialtytraining.hee.nhs.uk/Portals/1/2021%20Competition%20Ratios_1.pdf (2021) Accessed on 18th October 2021
2. Gnanakumar S, Kostusiak M, Budohoski KP, Barone D, Pizzuti V, Kirollos R, Santarius T, Trivedi R. Effectiveness of Cadaveric Simulation in Neurosurgical Training: A Review of the Literature. World Neurosurg. 2018;118:88-96
3. Kumar S, Adhish VS, Chauhan A. Managing self for leadership. Indian J Community Med. 2014;39(3):138-142
4. Schultz K, McEwen L, Griffiths J. Applying Kolb's Learning Cycle to Competency-Based Residency Education. Academic Medicine. 2016;91(2):284

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Debating Cadaveric Dissection in Medical Schools: A Review of Anatomy Teaching in Contemporary Clinical Education

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Abstract
The teaching of anatomy at the undergraduate level in medical schools varies between institutions and has evolved significantly over the years. Cadaveric dissection was once the cornerstone of anatomical lessons, but its use has declined due to cost, regulation, and availability. In addition, there are a number of other modalities using modern technologies that call in to question the need for continuing cadaveric dissection. This article explores the value of cadaveric dissection and assesses the place in contemporary undergraduate medical education. The expectation that all should participate is now outdated and unrealistic. An amalgamation of different modalities is likely to be the best compromise; computer-assisted learning and techniques such as plastination should be used for all undergraduates as they are powerful, accessible and relatively economical. Selective cadaveric dissection should be reserved for the subset of undergraduates who will benefit most from the tactile experience, such as those expressing an interest in surgical specialities.

Key Words
Cadaveric; Dissection; Medical School; Anatomy; Teaching

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Introduction

The evolution of anatomy teaching has taken us a long way from Herophilus[1] to the early medical schools, where teaching was based largely on cadaveric dissection (detailed analysis of a dead body by cutting it apart). Technological advances have provided a variety of media with which it can now be supplement. Modern medical school curricula use these methodologies as an alternative and, in many institutions, cadaveric dissection has been superseded entirely, with computer-led simulation tools becoming the cornerstone of anatomy teaching. This review will analyse the relevant issues, set out some of the central arguments for and against cadaveric anatomy teaching, and answer one central question: should cadaveric dissection continue to be available to all medical undergraduates?

Historical Review and the Momentum for Change

History of Anatomy Teaching

Considered the Father of Anatomy, Herophilus (c335BC – c280BC) undertook the first scientific human cadaveric dissections, revealing major anatomical discoveries.[1] Some 400 years later, Galen advanced anatomy teaching, believing that dissection enabled him to progress significantly in medicine, with an anatomic conception of disease.[2] Although not a doctor, Leonardo da Vinci is credited with furthering our anatomical knowledge through work reliant on careful cadaveric dissection[3] conveying this information brilliantly in drawings.

It was not until Vesalius that significant further anatomical studies and literature were published. Until then, anatomy teaching was Galenic, and apprentice barber-surgeons may have gained little knowledge from their lessons. Vesalius, in 1537, was given the duty of lecturing on anatomy. Vesalius set precedence by introducing cadaveric dissection to medical school anatomy teaching. This was a major novelty, and the interest increased the supply of dissection material using executed criminals authorised by the local official, at times delaying an execution to a time suitable for dissection.[4]

Despite the gruesome historical sourcing of dissection material, some form of governance in the United Kingdom has existed for centuries. The Murder Act of 1751 legislated that only corpses of executed murderers should be used for dissection,[5] while the Human Tissue Act of 2004 governed the

removal, storage, use, and disposal of human bodies, organs, and tissues.[6] The regulation evolved to meet the changing public expectations of medical professionals, while recognising the ongoing requirements.

Modern Developments

Technological advancements have changed the face of medical practice, and this is reflected in medical teaching. Radiological imaging and multimedia tools have long been adjuncts to cadaveric dissection in anatomy teaching in medical schools. More recently, the development of computerised three-dimensional (3D) models has been a paradigm shift, providing detailed images of both normal anatomy and the changes seen in disease.[7] Unlike books and older technologies, 3D tools allow a view of spatial relationships. Prosections (a dissection by an experienced anatomist for demonstration) have been more widely used, and more recently plastination (a preserving technique where water and fat are replaced by certain plastics)[8] has been developed.

Evolving Medical Curricula

There has been a decline in the amount of time devoted to undergraduate anatomy teaching over the last 20 years. 7 Contributing factors include the reduced length of undergraduate curricula, a shift in the emphasis from basic sciences to patient-centred teaching, and the need for a wider range of subjects including humanities. Reformers argue that traditional basic science teaching did not connect students with living patients.[9] Many view dissection-based learning as an archaic, privileged 'Rite of Passage'[9] rather than an educationally enriching process.[8]

Anatomical knowledge remains the cornerstone of medical education, and today's litigious society demands a good foundation in anatomy.[8] Since the high-profile plastination exhibits of Professor Von Hagens,[8] the public expects that all doctors have sound anatomical knowledge, irrespective of their specialty. However, a major area of the debate must centre on timing. Should undergraduate education be focused on training generalists or specialists?8 Approximately half of medical students in the United Kingdom (UK) will become general practitioners.[10] This does raise the question of cause or effect. One report suggested an increased need for general practitioners and proposed a need for training to shape this change.[11]

Limited availability of cadaveric supplies has led to a need for the development of alternative learning resources.[7] The dissecting room is expensive.[9] Students can use computer-based teaching models at their convenience and the software is not subject to the same rigorous regulations as cadaveric models.[7]

Judging the adequacy of anatomical knowledge is contentious. Some studies argue that as few as a quarter of medical students had anatomical knowledge deemed adequate for clinical practice.[12] Worryingly, reports have suggested an increase in the number of adverse clinical incidences relating to poor anatomical knowledge (Goodwin, 2000).[13] Settlements of claims based on a finding of "damage to underlying structures", attributed in part to gaps in anatomical understanding, are of grave concern for patient safety and have significant financial implications for the National Health Service (NHS).[13]

In this context, we will explore the following three questions in detail:
1) Why dissect at all?
2) Does cadaveric dissection have a place in modern anatomy teaching curricula?
3) Is cadaveric dissection irreplaceable?

Why Dissect at all?

The Arguments for Dissection:

The evolution from the "body-snatching" era to modern methods of donation has been an important step in changing anatomical dissection from simply a tool for knowledge acquisition to a "vehicle for moral and ethical education".[14] Respect and reflection on issues around death are brought to the mind of the learner through dissection while developing one's professional values and accountability.[15] It assists the development of clinical detachment and empathy,[15] a careful balance for each individual. Swick viewed dissection as a modality to guide students in learning how to effectively use their affective responses while promoting active learning of professional behaviour and attitude.[16]

Dissection has a role in acclimatising students to the realities of death and teaching manual dexterity and touch-mediated perception.[7] Indeed, the sensation of feeling human flesh learnt while dissecting cannot be provided in any comparable way with alternative learning tools.[17] Another important lesson harnessed by the dissection room teaching is that of teamwork between collaborating students, realising the importance of effective communication within the group.[18] This encompasses another important principle of "Tomorrow's Doctors" in the UK,[19] providing students with not only the necessary knowledge but also the skills and behaviour required in the medical profession.

Knowledge acquisition through dissection improves

mental imagery and recall capacity.[20] A parallel has yet to be proven with other methods. Inaccuracies may be recorded in atlases which may have significant implications surgically and will only be detected by those who dissect on a frequent basis.[15] There is unpredictable anatomical variation in cadavers9 which cannot be replicated in models. Hildebrandt goes further to suggest that collective anatomical knowledge may be diminished if we abandon the art of dissection.[15] Sugand supports this, stating that a move away from cadaveric teaching may result in "incompetent anatomists and healthcare professionals, leaving patients to face dire repercussions".[17]

The Arguments Against Dissection:

We live in an era in which we would hope to promote the development of compassionate and caring medical professionals. Should we continue to subject them to acts requiring "a certain inhumanity" during their training, as described by William Hunter,[15] or, as Ware put it to students in 1851, creating a "difference between us and other men in the feelings with which we regard the remains of the dead"?[15] Several studies have shown that students experience considerable anxiety and stress with dissection,[21] and failure to develop defence mechanisms may make this incapacitating. An overdevelopment of these mechanisms may result in detachment, and indifference and cynicism may emerge.[21]

The reform of medical education in The United States of America was deemed necessary to fulfil the potential of active student-driven learning and a move away from lectures.[15] Within the reform of anatomy teaching, those who had admittedly appreciated dissection within their own learning recognised the need to shift towards a curriculum in which "only the essential and part of the useful become required work".[31] It was apparent that, for the majority of medical trainees, anatomy would not be the main focus of their education, and additional elective courses could be provided to those students who desired a deeper understanding of the subject. This anatomical teaching doctrine was considered highly successful and influential at the John Hopkins Medical School.[15]

Flexner delivered a fairly scathing assessment of dissection rooms in his report in 1910 as "rarely clean, always unattractive and not frequently unpleasant".[22] This highlights the health implications of working with cadavers which, in such times, involved prolonged exposure to formalin.[22] Medical training in the past has been guilty of teaching students excessive detail with little comprehension of the clinical relevance.[8] Anatomical knowledge accrued in this way has very little educational validity.[8] Modern teaching places clinical applications at the centre of its focus, thus encouraging a more student-led approach to understanding anatomy in a systems-based way.

Does Cadaveric Dissection have a Place in Modern Anatomy Teaching Curricula?

The Arguments for Dissection:

Curricular reform has led to a reduction in time and content of anatomy teaching.[15] Drake's analysis in America saw a reduction in the curricular time spent on anatomy from 335 hours in 1955, to 195 in 1973, and 149 by 2009.23 Anatomical knowledge is at risk of falling short of a safe level,[17] and the shift away from cadaveric teaching may fail to provide adequate assimilation of core knowledge.8 The GMC's "Tomorrow's Doctors"[19] sets out an aim for a medical curriculum with a greater emphasis on communication skills. However, as observed by Dawson et al. "good communication requires a sound knowledge base".[12]

It is hard to compare the overall financial differences between cadaveric dissection and computer-based teaching as constructing computerised three-dimensional models is undoubtedly very expensive and no studies have compared this to the cost of cadaveric anatomy teaching overall.[7] Students need computers of a reasonably high specification to fully appreciate the best quality computerised models, thus imposing an additional cost to the software alone. Even then these models do not provide a sense of touch and are, at best, iconic abstractions of the real subject.[7]

Analysis of students' perceptions on use of cadaveric dissection in modern medical curricula shows ongoing support for its ability to enhance learners respect for the human body and made learning more interesting.[24] Participants have also conveyed that cadaveric dissection has deepened their knowledge and understanding of anatomy.[24]

The Arguments Against Dissection:

Modern physicians need not only scientific training but to develop humane skills such as empathy and compassion. This has been adopted by modern curricula that centre on this integration of skills in a problem-based and clinical-presentation based approach.[15] With this change in the emphasis of modern medical teaching, it is important that anatomy teaching becomes more efficient by providing essential knowledge at a clinically relevant level.[15] This has heralded the need for alternatives to dissection, with the use of radiology, computer models, and interactive multimedia tools. In conjunction with prosections, these allow students to integrate their acquired knowledge.

The fundamental philosophy behind modern medical teaching is the concept of active learning. The importance of this was recognised by Mall much earlier, but more recently it is based on insights from cognitive science.[15] In America, Mall's idea of basic anatomy for all and selectively taught higher level anatomy to those with specific interest has been highly successful[15] and widely implemented. Chevrel supports this idea, with the proposal of modern computer programs providing anatomy teaching at "successive stages of increasing specificity" tailored to meet the needs of individual students.[25]

The main disadvantage of cadaveric dissection, as perceived by the learner, is that it is a time-consuming learning method.[24] Sometimes this can come at the expense of teaching in other basic science subjects. In conjunction with the smell and the perceived difficulty in finding the assigned structures, non-attendance at cadaveric dissection teaching by a fifth of students[24] calls into question the role of such an expensive modality.

Is Cadaveric Dissection Irreplaceable?

The Arguments for Dissection:

There are modern technologies available that aim to replace dissection. Proponents of cadaveric dissection see these tools merely as supplements. Modernists claim that the implementation of advanced methods such as virtual reality environments require a "relatively modest" financial investment,[25] although there is a reluctance to quantify this further. High specification computers may not be an inconsiderable outlay, particularly when considering anatomy education globally. Computer-generated models lack variation and pathology of the real human body.[20] Plastinated models have been described as "waxy and brittle" and difficult to relate to reality.[20]

The Arguments Against Dissection:

The parallel of the outdated blackboard and the cadaver is highlighted by Chevrel, who sees modern imaging techniques as crucial to the diffusion of anatomy knowledge.[25] With computer tomography, ultrasound, and magnetic resonance imaging in static and functional modes providing 3D reconstructions, we are in a technological environment that has surpassed the need for archaic tools.[25] Integration of internet resources into anatomy teaching is an important innovation. The internet is widely available and allows flexible access to a wide range of learning materials. Interactive modules cover conceptually complex topics.[15] Computer availability to learners allows repetition and quick visual comparisons in a way that dissection cannot match.[26]

Computer-assisted learning and computer-assisted instruction describe interactive teaching methods using two- or three-dimensional training models, including virtual reality. This method of delivery has been compared to traditional methods of anatomy teaching using lectures and models. It compares favourably when measuring educational outcome levels and provides a time-efficient, convenient teaching tool.[27]

Discussion

Medical curricula in modern universities must consider cost implications, time constraints, and the volume of knowledge and skills to deliver. There is a lengthy historical background to dissection, which encourages us to continue to value this privilege. It is, nonetheless, perhaps outdated and cannot continue as the sole method of teaching anatomy, without considering the alternatives.

Advances in computer technology have enabled the development of virtual reality environments allowing 3D perspectives, unlimited repetition, and student-directed learning.[25] Interestingly, while educationalists may be tending to move away from dissection, there is evidence that students are keen to see it continue to form a part of their curriculum. However, the evidence from higher-level anatomy teaching, including surgical training, points to a move towards non-cadaveric-based learning. There is increased use of simulation models, often using animal tissue to reproduce the tactile experience.[25]

There are other advantages to newer technologies. Virtual collaborative environments provide more rapid knowledge acquisition and require less cognitive effort when compared to traditional educational practices.[28] Plastinated models have been shown to enhance students' learning and interest[15] and are durable and odourless.[26] Surgical prosections and plastinated models are a time-saving resource and are easily demonstrable, helping to overcome staffing issues and cadaver shortage.[26] The role of dissection in developing dexterity may also be replaced[29] with computerised tools and various surgical simulation modalities, including bench-top models, laparoscopic simulators, and robotics.[30]

There is however a lack of clear evidence on the effectiveness of the various approaches to the teaching and learning of anatomy, and newer technological alternatives to dissection have not undergone rigorous comparative testing. Most authors recognise a place for dissection alongside these alternatives as continuing to provide contact with the reality of the body and a clear understanding of the topography of different regions.[25] Sugand advocates the combination of

medical imaging with cadaveric dissection to produce a greater level of student interest in gross anatomy.[17]

Collins is undoubtedly right that the time given in the curriculum to anatomy is certainly unlikely to increase, and modern teaching must, therefore, deliver within this restriction.[29] However, his assertion that the benefit of dissection is limited to those requiring more detailed anatomical knowledge is contentious, and there is a need for further research to lay to rest emotive and anecdotal arguments.[29]

Dissection requires more time and specific training to meet the educational needs of the learner. With the significant reduction in the hours allocated to anatomy teaching in medical schools, this method may no longer be feasible.[20] In designing a medical course, Scott recognised the time pressures and, by tailoring the course expectations to the clinical needs of an early 'undifferentiated' physician, was able to reduce the course hours from 320 to 98.30 This Canadian course in the 1990s replaced dissection with prosections and radiological images and was deemed favourable by both students and faculty alike.[30] It also proved more efficient, requiring fewer faculty to deliver the curriculum.

Conclusions

Returning to the question posed at the outset of this review, the requirement for cadaveric dissection to be available to all medical undergraduates is supported. However, the expectation that all should participate is unrealistic. The ideal compromise is the continued availability of cadaveric dissection for a subset of undergraduates in all medical schools, catering for those with a particular interest to further their anatomical studies and who will benefit most from the tactile experience of dissection. This could take the form of regional centres catering for a group of medical schools to electively participate students in the form of a 'special study module' and would reduce cost.

A complementary amalgamation of cadaveric dissection with computer-assisted modalities is likely to provide the best format for acquiring both knowledge and skills. The evolution of anatomy teaching should reflect the significantly more advanced way in which we now operate and practice. We are a long way from the barber-surgeons of the past and, as we move towards an era of minimal access and robotic surgery, tomorrow's surgeons will value a similarly innovative approach to their training.

References

1. Wi--Itse LL, Pait TG. 1998. Herophilus of Alexandria (325-255 B. C.). The father of anatomy. Spine (Phila Pa 1976.) 23(17):1904-1914.
2. Singer C. 1949. Galen as a Modern. Proc R Soc Med. 42:563-570.
3. De Saunders JB. 1955. Leonardo da Vinci as anatomist and physiologist: a critical evaluation. Tex Rep Biol Med. 13:1010-1026.
4. O'Malley CD. 1964. Andreas Vesalius 1514-1564: In Memorium. Med Hist. 8:299-308.
5. Murder Act 1751. 25 Geo 2 c37: An act for better preventing the horrid crime of murder. The Statutes Project. http://statutes.org.uk/site/the-statutes/eighteenth-century/1751-25-geo2-c37-muder-act/. [accessed date: 3rd November 2020].
6. Human Tissue Act 2004. Human Tissue Authority. http://www.hta.gov.uk/policies/human-tissue-act-2004. [accessed date: 23rd June 2020].
7. Brenton H, Hernandez J, Bello F, Strutton P, Purkayastha S, Firth T, Darzi, A. 2007. Using multimedia and Web3D to enhance anatomy teaching. Computers & Education. 49:32-53.
8. Turney BW. 2007. Anatomy in a modern medical curriculum. Ann R Coll Surg Engl. 89 (2):104-107.
9. Older J. 2004. Anatomy: A must for teaching the next generation. The Surgeon. 2:79-90.
10. General Medical Council. 2012. List of Registered Medical Practitioners – statistics. www.gmc-uk.org/doctors/register/search_stats.asp. [accessed date: 16th Jan 2021].
11. Goddard S. 2003. A history of gross anatomy – lessons for the future. Univ Toronto Med J. 80:145-147.
12. Dawson AG, Bruce SAM, Heys SD, Stewart IJ. 2009. Student views on the introduction of anatomy teaching packages into clinical attachments. Clin Anat. 22:267-272.
13. Goodwin H. 2000. Litigation and surgical practice in the UK. Br J Surg. 87:977-979.
14. Dyer GS & Thorndike ME. 2000. Quidne mortui vivos docent? The evolving purpose of human dissection in medical education. Acad. Med. 75(10):969-979.
15. Hildebrandt S. 2010. Lessons to be learned from the history of anatomical teaching in the United States: the example of the University of Michigan. Anat Sci Educ. 3:202-212.
16. Swick HM. 2006. Medical professionalism and the clinical anatomist. Clin Anat. 19(5):393-402.

17. Sugand K, Abrahams P, Khurana A. 2010. The anatomy of anatomy: a review for its modernization. Anat Sci Educ. 3:83-93.
18. Evans DJ, Watt DJ. 2005. Provision of anatomical teaching in a new British medical school: getting the right mix. Anat Rec. 284B (1):22-27.
19. General Medical Council. 2016. Outcomes for graduates. https://www.gmc-uk.org/-/media/documents/Outcomes_for_graduates_Jul_15_1216.pdf_61408029.pdf. [accessed date: 10th Jan 2021].
20. Hasan, T. Ageely H. & Hasan D. 2010. The role of traditional dissection in medical education. Education in Medicine Journal. 2(1), e30-e34.
21. Aziz MA, McKenzie JC, Wilson JS, Cowie RJ, Ayeni SA, Dunn BK. 2002. The human cadaver in the age of biomedical informatics. Anat Rec. 269:20-32.
22. Flexner A. 2002. Medical education in the United States and Canada. From the Carnegie Foundation for the Advancement of Teaching, Bulletin Number Four, 1910. Bull World Health Organ. 80(7):594-602.
23. Drake RL, McBride JM, Lachman N, Pawlina W. 2009. Medical education in the anatomical sciences: the winds of change continue to blow. Anat Sci Educ. 2(6):253-9.
24. Dissabandara LO, Nirthanan SN, Khoo TK, Tedman R. 2015. Role of cadaveric dissections in modern medical curricula: a study on student perceptions. Anat Cell Biol. 48(3):205-212.
25. Chevrel JP. 1995. The modern teaching of modern anatomy. Surg Radiol Anat. 17:285-286.
26. Hasan T, Ageely H, Bani I. 2011. Effective anatomy education - A review of medical literature. RMJ. 36(3):225-229.
27. Losco CD, Grant, WD, Armson A, Meyer AJ, Walker BF. 2017. Effective methods of teaching and learning in anatomy as a basic science: A BEME systematic review: BEME guide no. 44. Med. Teach. 39(3):234-243.
28. Chittaro L & Ranon R. 2007. Web3D technologies in learning, education and training: Motivations, issues, opportunites. Computers & Education. 49:3-18.
29. Collins JP. 2008. Modern approaches to teaching and learning anatomy. BMJ. 337:a1310.
30. Scott TM. 1993. How we teach anatomy efficiently and effectively. Med Teach. 15:67-75.
31. Mall FP. 1908. On the teaching of anatomy. Anat Rec 2:313–335.

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Barriers to HPV Vaccination and Cervical Cancer Prevention at Health Personnel Level During the COVID-19 Pandemic in Eldoret, Kenya

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Abstract

Background: Cervical cancer remains the chief cause of cancer mortality among women in low-resource settings. The advent of the HPV vaccine constitutes a milestone in cervical cancer prevention. Reproductive healthcare providers perform cervical screening and vaccination in Kenya, and little information is currently available about their knowledge, attitudes, and acceptability of the HPV vaccine.

Objectives: The objectives of the study are to determine health personnel knowledge, attitudes and acceptance surrounding cervical cancer and the HPV vaccine in Kenya, to identify structural problems hindering cervical cancer prevention, and to utilize this information to make policy recommendations.

Methods: A cross-sectional survey was conducted to evaluate acceptability, knowledge, and attitude regarding HPV, cervical cancer, and HPV vaccine among healthcare personnel working at the Moi Teaching and Referral Hospital (MTRH), Kenya and reproductive health specialists attending an annual scientific conference. We utilized convenience sampling by a self-administered, anonymous questionnaire.

Results: Our findings revealed a high level of divergence between knowledge of HPV infection and vaccines. A mean score of 2.27, indicating a negative attitude among healthcare workers, was calculated, with 36.8% expressing concern that the HPV vaccine may result in promiscuity. A total of 81.4 % of healthcare workers either strongly agreed or agreed that communication between children and parents to have the HPV vaccination might be a problem in Kenyan culture. Subgroup analyses revealed statistically significant differences in knowledge concerning the target group of the HPV vaccine.

Conclusion: Significant divergent knowledge among workers on HPV and vaccines may limit HPV vaccine uptake or target the wrong age group. There is an urgent need to bridge this information gap through a well-designed HPV education program for medical personnel. Our findings illustrate the need for continued medical education for healthcare workers according to gender, site location, medical profession, and years of work

Key Words
Healthcare Personnel; Kenya; HPV Vaccine; Knowledge; Attitude; Structural Problems

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Background:

Human papillomavirus (HPV) infection of the genital mucosa is a common sexually transmitted infection (STI), and its central role in the etiology of cervical cancer has been established.[1] Among asymptomatic women in the general population, the prevalence of HPV infection ranges from 2-40%.[2] The prevalence of HPV varies with age, and HPV is most prevalent in younger populations, especially within the age range of 20-30 years.[3,4] Approximately 50% of HPV infections occur in sexually active adolescent girls and young women.[5]

Cancer is the third leading cause of death in Kenya, with a rate of 18,000 deaths per year.[6] Cervical cancer is the second most prevalent cancer among women in the country after breast cancer, and its incidence is rising.[7] In many industrialized countries, however, the incidence of cervical cancer is lower, which can be attributed to the widespread implementation of cervical screening programs.

According to the World Health Organization (WHO), 39 percent of Kenyan women have harboured an HPV infection at some point in their lives. Factors impacting on high risks of cervical cancer in Kenyan women include multiple pregnancies, early age of first intercourse, hormonal contraceptives, smoking, and HIV infection.[10,11] For a woman living with HIV, a HPV infection can develop into cervical cancer more quickly than for a woman who is HIV negative. The high incidence of HIV in Kenya is an important consideration when establishing a strategy against cervical cancer. A

Kenyan study conducted from 2007 to 2010 reported that, in order to target vulnerable populations, it is beneficial to combine cervical cancer screening with HIV testing.[12]

Currently, there are highly efficacious vaccines approved for females aged 9-26 years.[13] The first is Quadrivalent HPV vaccine, or Gardasil®, the first vaccine for the prevention of cervical cancer, abnormal and precancerous cervical lesions, abnormal and precancerous vaginal and vulva lesions, and genital warts. The other is CervarixTM, or bivalent HPV, the second vaccine for the prevention of cervical cancer and precancerous lesions associated with the most common cancer-causing HPV types, 16 and 18.

Although the Kenya Pharmacy and Poisons Board approved the use of the HPV vaccination in 2007, its purchase is not affordable for most Kenyans. Two vaccinations, Cervarix, and Gardasil, currently cost around $300 (all figures USD) and $150 respectively.[14] Until the cost of these HPV vaccinations decreases or less expensive options become available, inoculation is not viable in Kenya without substantial subsidies.

However, the acceptance of the vaccine might be related to other factors for decision making in vaccination of the population other than the price alone, such as the acceptance by healthcare providers.[15] Healthcare providers have been found to play a pivotal role in influencing parents' decision making to allow their children to receive the HPV vaccination.[16] The acceptance of the HPV vaccine from healthcare workers (HCWs), therefore, might result in HPV vaccine implementation in the future. Despite low to moderate levels of knowledge about HPV vaccine among school teachers, vaccine acceptability is high. Teachers with little knowledge of the HPV vaccine are less likely to accept the vaccine than those who know more; this may affect uptake if not addressed. Empowering teachers to be vaccine champions in their community may be a feasible way of disseminating information about the HPV vaccine and cervical cancer.

Although the HPV vaccine has been used in Kenya for five years, there is little or no information about HPV vaccine acceptability among HCWs working in Kenya, unlike in industrialized settings. Healthcare providers are expected to have good acceptance and a positive attitude toward the HPV vaccine. Moreover, they are also expected to have good knowledge of the HPV vaccine, as well as the HPV infection and its relation to cervical cancer. In addition, they are considered the primary and most trusted source of health and vaccine information for the public.

The objectives of this research are threefold. The first is to assess HPV vaccine acceptability, knowledge and attitudes regarding HPV, cervical cancer, and HPV vaccine among HCWs and to identify structural problems. The second is to determine differences in knowledge according to different medical professions, gender, years of work, and outpatient location. The third is to make policy recommendations for HPV education interventions.

Materials and Methods

Study Design and Setting

This study is a cross-sectional survey of healthcare providers and involved healthcare workers (HCWs) working in the Department of Reproductive Health at the Moi Teaching and Referral Hospital, Eldoret, Kenya. It also involved data retrieval from a questionnaire administered to Obstetricians and Gynaecologists attending an annual scientific conference in Eldoret based in Uasin Gishu County in Kenya. Eldoret is a principal city in Western Kenya and lies south of Cherangany hills, the location elevation varies from about 2100 metres above the sea level to more than 2700 metres (7000 – 9000 feet. Data collection was undertaken in February 2015 using a self-administered questionnaire.

The questionnaire contained multiple-choice questions. Questions included demographics and socio-professional questions, questions on the knowledge of the epidemiology of cervical cancer, the HPV infection and its link to cervical cancer, questions on the knowledge and attitudes regarding HPV, cervical cancer, and the HPV vaccine, and questions on the acceptability of the HPV vaccine. Other professionals included anaesthetists and pharmacists working in reproductive health, as well as residents and students.

Knowledge of cervical cancer included the cause, risk, and screening. Knowledge of the HPV vaccine focused mainly on the efficacy and its benefit. The Health Belief Model (Glanz) was applied to develop the questions about attitudes. These questions focused on the perceived severity of cervical cancer, the perceived benefit of the vaccination, and perceived barriers to vaccination. These three factors could be expected to influence decisions about HPV vaccine acceptance among healthcare providers. Questions about acceptability were based on characteristics of the vaccine (i.e., vaccination procedure, cost, benefit, and target group of vaccination).

We tested the reliability of the questionnaire among 15 healthcare providers that included ten residents and five nurses in the Division of Reproductive

Health of the Moi Teaching and Referral Hospital. The questionnaire was delivered by hand during working hours and collected by a research assistant. The Obstetricians/Gynaecologists attending an annual conference were given the questionnaire by the researcher who was assisted by research assistants, and the survey was collected back on the same day.

Each participant received written explanations about the objectives of the study.

Recruitment Strategy and Sample Size

Due to the unavailability of previous information about the topic for the three categories of professionals, obstetricians/gynaecologists, nurses, general practitioners and others, we did not formally calculate thesample size. Instead, a convenient sample was employed**.**

Data Analysis

Data were analyzed using a statistical software program (STATA, version 12.1). Descriptive statistics were generated, and data were presented as a mean (standard deviation) or median (range) for continuous variables and years of providing care, and as a percentage for categorical variables, including gender and main outpatient practice.

Knowledge was presented by frequency and percentage in each item. Attitude assessment was categorized on a five-level Likert scale that ranges from 1 for "Strongly Disagree," to 5 for "Strongly Agree". These were presented in percentage. The level of attitude was calculated from the mean scores and grouped into three classes: 1-2.33 = "Negative"; 2.34-3.67 = "Neutral"; 3.68-5 = "Positive". Overall attitude was presented by mean/ median scores.

The number of years of providing clinical care was dichotomized into <8 years and ≥8 years; this categorization was used to reflect the median years of HCWs. The chi-square test was used to compare the differences in the proportions of knowledge and attitude across medical professions, gender and >8 years of professional experience. An independent *t*-test/Mann Whitney test for nonparametric values was used to compare the mean/median differences of knowledge and attitudes between nurses and medical doctors, residents, and gynaecologists. The data collected were analyzed, and P-values <0.05 were considered significant.

Socio-Demographic Characteristics

A total of 196 questionnaires were completed and returned, of which (63.27%) were male HCWs and (36.7%) were female HCWs. The response rate was 98.5%. Most staff respondents were obstetrician-gynaecologists (65/193; 33.7%), followed by general practitioners (61/193; 31.6%), followed by others (40/193; 20.7%), followed by nurses (27/193; 14.0%). The median number of years of experience in healthcare provision for the participating healthcare providers is eight years (IQR 4-13). The remaining proportion of healthcare providers categorized as others is accounted for in Table 1 below. A majority of the healthcare providers mainly carry out their practice in the three locations tabulated, with the greatest proportion (58.3 %) under the public healthcare facilities. The socio-demographic characteristics of the respondents are outlined in

Table 1: Socio-Demographic Characteristics

Variable	**n**	**%**
Gender		
Male	124	63.3
Female	72	36.7
Years of Clinical Care	8	(IQR: 4-13)
Location of Practice		
Private practice office	42	22.7
Public health center	108	58.4
Hospital department	29	15.7
Other	6	3.2
Medical Speciality		
Obstetrician/ Gynaecologist	65	33.7
Nurse	27	14
General Practitioner	61	31.6
Other	40	20.7

***Knowledge of HPV Genotypes*:**
The majority (81.2%) of participants disclosed that, in their opinion, there are over 100. HPV type 16 and 18 were the most (85.2%) cited for causing cervical types of HPV cancer.
Knowledge of HPV Vaccines:
Knowledge of to whom and when the HPV vaccine should be administered diverged among those surveyed (see Table 2).

Table 2: Assessing HPV Vaccine Knowledge

Variable	**n**	%
How many types of HPV are there?	Over 100	81.2%
What types of HPV cause cervical cancer most?	HPV 16 and HPV 18	85.20%
How many types of HPV vaccine are available for cervical cancer prevention?	2 vaccines	56.4%
To which age group should the HPV vaccine be given?	10-30 y	70.10%
Both boys and girls should get the HPV vaccine before he/she becomes sexually active	Yes	69.80%
Can the HPV vaccine be given to a sexually active girl?	No	17.20%
Do girls/women need to be screened for HPV before getting vaccinated?	Yes	59.90%
Can it be given to a woman who already has an HPV infection?	No	68.8%
How many doses of the HPV vaccine are required for protection?	3	80.20%
Is it safe to give HPV vaccine to HIV-infected persons?	Yes	73.10%

Attitude:
A total of 70.3% of respondents either agreed or strongly agreed that vaccine safety was a concern, whilst 36.8% of respondents were either ambivalent or agreed that the HPV vaccine may lead to an increase in risky sexual behaviour.
Overall Attitude Score:
Safety concerns: mean 2.3 (95% CI: 2.1- 2.4); Promiscuity concern: mean 2.27 (95% CI: 2.1-2.4)

Structural Problems
Eighty one percent either strongly agree or agree that communication between children and parents to have the HPV vaccination might be a problem in Kenyan culture. A total of 55.7% either strongly agree or do not agree that a well-informed child should be able to request the vaccination without parental consent. A total of 55.7% believe that the high cost may constitute an important obstacle, and 35.9% maintain that inadequate information may be an obstacle (see Table 3).

Table 3: Attitude and Structural Problems

Variable	**Agree (N=193) %**
Are people worried about vaccine safety?	70.30%
The HPV vaccine can lead to an increase in risky sexual behaviour	36.80%
Structural Problems	
Communication between children and parents to get HPV vaccination might be a problem in Kenyan culture	81.40%
A well-informed child should be able to request vaccination without parental consent	55.70%
What do you think will be the most important obstacle preventing yourself to receive/advice HPV vaccination?	Cost: 55.7 %
	35.9% inadequate information
What is the cost of 1 dose of the HPV vaccine?	Kshs 2000: 35.23%

Table 4: Bivariate Analysis between HPV Vaccine Knowledge, Structural Problems and Attitude Against Gender

Variable	n	%	P Value
How many types of HPV are there?	Over 100	81.2%	p= 0.7
What types of HPV causes cervical cancer most?	HPV 16 and HPV 18	85.20%	p= 0.1
How many types of the HPV vaccine are available for cervical cancer prevention?	2 vaccines	56.4%	p=0.4
To which age group should the HPV vaccine be given?	10-30 y	70.10%	p=0.04
Both boys and girls should get the HPV vaccine before he/she becomes sexually active.	Yes	69.80%	p=0.8
Can HPV vaccine be given to a sexually active girl?	No	17.20%	p=0.8
Do girls/women need to be screened for HPV before getting vaccinated?	Yes	59.90%	p=0.5
Can it be given to a woman already having HPV infection?	No	68.8%	p=0.5
How many doses of HPV vaccine are required for protection?	3	80.20%	p=0.9
Is it safe to give HPV vaccine to HIV-infected persons?	Yes	73.10%	p=0.7
Attitude			
People are worried about vaccine safety?	Agree	70.30%	p=0.03
The HPV vaccine can lead to an increase in risky sexual behaviour	Agree	36.80%	p=0.06
Structural problems			
Communication between children and parents to get HPV vaccination might be a problem in Kenyan culture.	Agree	81.40%	p=0.9
A well-informed child should be able to request vaccination without parental consent	Agree	55.7%	p=0.4
What do you think will be the most important obstacle preventing you from receiving/advising the HPV vaccination?	Inadequate information	55.7%	p=0.6
	Cost	35.2%	p=0.7

P-value for a *chi-square* test

An association was found between gender and vaccine safety (p = 0.03), with 66.7% of men and 76.4% of women agreeing that people are worried about vaccine safety. Female and male HCWs also differed in their answers concerning the age group to which the HPV vaccine should be administered (p=0.04), with 63.4% of male HCWs and 81.7% of women answering that 10-30 years is the age group that should be receiving the vaccine.

Table 5: Bivariate Analysis between HPV Vaccine Knowledge, Structural Problems and Attitude Against Years of Practice (Below 8 Years of Age vs. Above 8 Years of Age)

Variable	**n**	**%**	**P Value**
How many types of HPV are there?	Over 100	81.2%	p=0.7
What types of HPV cause cervical cancer most?	HPV 16 and HPV 18	85.20%	p=0.3
How many types of the HPV vaccines are available for cervical cancer prevention?	**2 vaccines**	**56.4%**	**p=0.002**
To which age group should the HPV vaccine be given?	10-30 y	70.10%	p=0.2
Both boys and girls should get HPV vaccine before he/she becomes sexually active	**Yes**	**69.80%**	**p< 0.001**
Can HPV vaccine be given to a sexually active girl?	No	17.20%	p=0.3
Do girls/women need to be screened for HPV before getting vaccinated?	**Yes**	**59.90%**	**p=0.003**
Can it be given to a woman already having an HPV infection?	**No**	**68.8%**	**p=0.002**
How many doses of the HPV vaccine are required for protection?	3	80.20%	p=0.9
Is it safe to give HPV vaccine to HIV-infected persons?	Yes	73.10%	p=0.9
Attitude			
People are worried about vaccine safety?	Agree	70.30%	p=0.4
The HPV vaccine can lead to an increase in risky sexual behaviour	Agree	36.80%	p=0.04
Structural problems			
Communication between children and parents to get HPV vaccination might be a problem in Kenyan culture.	Agree	81.40%	p=0.4
A well-informed child should be able to request vaccination without parental consent	Agree	55.7%	p=0.8
What do you think will be the most important obstacle preventing you to receive/advice HPV vaccination?	Inadequate information	55.7%	p=0.2
	Cost	35.2%	p=0.8

P-value for a *chi-square* test.

A chi-square test done to test for association between HPV vaccine knowledge against years of medical practice showed a significant association between the types of cervical cancer, whether boys and girls should get the HPV vaccine, whether women need to be screened before the vaccination, and whether the vaccine should be given to a woman if she already has HPV infection with a p-value of 0.002, 0.001, 0.003 and 0.002, respectively.

Table 6: Bivariate Analysis between HPV Vaccine Knowledge, Structural Problems and Attitude Against Medical Profession

Variable	**n**	**%**	**P Value**
How many types of HPV are there?	Over 100	81.2%	p<0.001
What types of HPV cause cervical cancer most?	HPV 16 and HPV 18	85.20%	p=0.06
How many types of the HPV vaccines are available for cervical cancer prevention?	2 vaccines	56.4%	p<0.001
To which age group should the HPV vaccine be given?	10-30 y	70.10%	p = 0.1
Both boys and girls should get HPV vaccine before he/she becomes sexually active	Yes	69.80%	p< 0.001
Can HPV vaccine be given to a sexually active girl?	No	17.20%	p= 0.6
Do girls/women need to be screened for HPV before getting vaccinated?	Yes	59.90%	p<0.001
Can it be given to a woman already having the HPV infection?	No	68.8%	p<0.001
How many doses of HPV vaccine are required for protection?	3	80.20%	p = 0.09
Is it safe to give HPV vaccine to HIV-infected persons?	Yes	73.10%	p= 0.1
Attitude			
People are worried about vaccine safety?	Agree	70.30%	p= 0.006
The HPV vaccine can lead to an increase in risky sexual behaviour	Agree	36.80%	p= 0.02
Structural problems			
Communication between children and parents to get HPV vaccination might be a problem in Kenyan culture.	Agree	81.40%	p=0.1
A well-informed child should be able to request vaccination without parental consent	Agree	55.7%	p=0.03
What do you think will be the most important obstacle preventing you to receive/advice HPV vaccination?	Inadequate information	55.7%	P<0.001
	Cost	35.2%	p=0.2

P-value for a *chi-square* test

A chi-square test revealed a statistically significant difference between knowledge among medical staff in the following areas: the number of HPV vaccines available for cervical cancer prevention (p<0.001), with obstetricians/gynaecologists (49.1%), general practitioners (20.9%), nurses (20.9%), and others (9.1%) answering two HPV vaccines; whether the HPV vaccine should be administered before he/she becomes sexually active was statistically different (p<0.001), with 78.9% of obstetricians/ gynaecologists, 36.2% of nurses, 52.2% of general practitioners, and 32.7% of others agreeing it should; screening of girls before HPV vaccination (p<0.001), with 15.2% of obstetricians/ gynaecologists, 10.7% of nurses, 47.3% of general practitioners, and 26.8% of others saying yes; whether it can be administered to a woman already infected with HPV (p<0.001), with 22.55% of

obstetricians/gynaecologists, 13.2% of nurses, 38.8% of general practitioners, and 25.6% of others stating that it cannot.

Statistical differences between HCWs perception were also observed in attitude and people's safety concerns (p=0.006), with 44.4% of obstetricians/ gynaecologist, 33.3% of nurses, 51.5% of general practitioners, and 82.5% of others either strongly agreeing or agreeing that people have concerns about the vaccine's safety; whether the HPV vaccine may lead to an increase in risky sexual behaviour (p=0.03), with 22.6% of obstetricians/ gynaecologists, 18.5% of nurses, 47.5% of general practitioners, and 52.5% of others expressing being either ambivalent or agreeing.

High cost and inadequate information were considered a handicap for advising on HPV vaccination, which differed per profession (p>0.001), with 75% of obstetricians believing that high cost would be an impediment. The majority of the healthcare workers (51.3%) reported that inadequate information on the HPV vaccine was a major barrier towards women receiving the vaccine.

Another area of discord (p=0.03) was whether a well-informed child should be able to request the vaccination without parental consent or not, with 79.8% of obstetricians/gynaecologists, 40.1% of nurses, 55% of general practitioners, and 25.1% of others agreeing.

Table 7: Bivariate Analysis between HPV Vaccine Knowledge, Structural Problems and Attitude Against Out-patient Practice Location

Variable	**n**	**%**	**P Value**
How many types of HPV are there?	Over 100	81.2%	p=0.2
What types of HPV cause cervical cancer most?	HPV 16 and HPV 18	85.20%	p=0.2
How many types of the HPV vaccine are available for cervical cancer prevention?	2 vaccines	56.4%	p=0.06
To which age group should the HPV vaccine should be given?	10-30 y	70.10%	p=0.6
Both boys and girls should get HPV vaccine before he/she becomes sexually active	Yes	69.80%	p=0.04
Can HPV vaccine be given to a sexually active girl?	No	17.20%	p=0.4
Do girls/women need to be screened for HPV before getting vaccinated?	Yes	59.90%	p=0.06
Can it be given to a woman already having an HPV infection?	No	68.8%	p=0.1
How many doses of the HPV vaccine are required for protection?	3	80.20%	p=0.9
Is it safe to give HPV vaccine to HIV-infected persons?	Yes	73.10%	p=0.04
Attitude			
People are worried about vaccine safety?	Agree	70.30%	p=0.4
The HPV vaccine can lead to an increase in risky sexual behaviour	Agree	36.80%	p=0.08
Structural problems			
Communication between children and parents to get HPV vaccination might be a problem in Kenyan culture.	Agree	81.40%	p=0.4
A well-informed child should be able to request vaccination without parental consent	Agree	55.7%	p=0.8
What do you think will be the most important obstacle preventing you to receive/advice HPV vaccination?	Inadequate information	55.7%	p=0.2
	Cost	35.2%	p=0.8

P-value for a *chi-square* test

There was a significant association with outpatient practice location and whether it is safe to give the HPV vaccine to HIV-infected people (p = 0.04), with 60% of private practice offices, 77.6% of public health centres, 82.8% of hospital departments, and 33.3% of "others" saying yes; whether both boys and girls should get HPV vaccine before he/she becomes sexually active (p = 0.04), with 66.7% of HCWs in private practice offices, 72.0% of HCWs in public health centres, 72.4% of HCWs in hospital departments, and 50.0% in other locations agreeing that both boys and girls should have the HPV vaccine before he/she becomes sexually active.

Discussion:

To our knowledge, this is the first study examining knowledge across different medical professions in various settings. Our study showed that the divergence of knowledge of the HPV infection and vaccines among HCWs was high.

Our survey highlighted some gaps in knowledge concerning the availability of the two HPV vaccines and the eligibility of the administration of the three-dose HPV vaccine. General practitioners, nurses, and professionals who come under "other" categories were poorly informed about the availability of the two HPV vaccines. There was also some discrepancy in knowledge concerning whether the HPV vaccine should be administered before a person becomes sexually active, with a smaller percentage of nurses, general practitioners and HCWs than the "other" category answering that it should.

Discrepant responses were observed in different outpatient settings, with HCWs from "other" locations disagreeing the most that the HPV vaccine should be administered before boys and girls become sexually active. Furthermore, a discrepancy was also found between gender, with a smaller percentage of male HCWs answering correctly that 10-30 years is the age group that girls should be receiving the vaccine. The lack of adequate information reported by general practitioners has also been reported as a setback to promoting HPV uptake.

Several studies have shown that existing national HPV education programs have led to improved awareness and knowledge of HPV infections among HCWs and the general public.[17,18] This study has highlighted that Continued Medical Education (CME) and Continuing Nurse Education (CNE) programs are pivotal to strengthening cervical cancer screening programs by ensuring adequate knowledge concerning prior HPV screening and the age group to which the HPV vaccine should be administered.

Our survey highlighted that the attitude was poor among HCWs, which can be interpreted as an indication of a poor incentivizing attitude to promote HPV vaccination uptake among HCW personnel. The concern that the HPV vaccine may lead to an increase in risky sexual behaviour is echoed across the spectrum of medical professions, with nurses, general practitioners, other medical professionals, and HCWs with less than eight years of experience expressing the greatest fear. This link established between HPV vaccination and promiscuity may constitute a considerable setback, as has been shown by other studies.[19,20]

Significant statistical differences between HCWs' perception of people's safety concerns were also shared across the spectrum of medical professions, with a higher percentage of female HCWs being especially concerned. These findings also underscore the need to allay safety concerns in the general population which, along with one-third of HCWs expressing lack of information, may hamper initiatives to promote HPV vaccine uptake. A sub-analysis study has also enabled us to identify the need for HCWs working in private practices to be updated on recent studies showing the immunogenicity and safety of the bivalent vaccines in HIV-positive women.[21]

Studies have also shown that for the HPV vaccination to be generally accepted among women, healthcare workers need to have knowledge of the vaccine in order for them to advise women on the advantages of the vaccine.[22]

This survey has also brought to the fore the need for enhanced communication between children and parents to obtain HPV vaccination in Kenyan culture. In light of this structural bottleneck qualitative, in-depth interviews are required to identify weaknesses and develop a more efficient HPV prevention communication strategy.

Strengths and Limitations:

This survey has the strengths of not only exploring knowledge and attitude across medical professions from different settings, but also exploring how knowledge differs by gender and work years. However, a limitation is that self-reported data to measure attitude may have been influenced by social desirability. In addition, given that attending the annual conference is not mandatory, the non-randomly selected HCWs attending the conference may be better informed and more inclined to update their knowledge of HPV vaccination and cervical cancer prevention than HCWs who did not attend.

Conclusion:
Overall, there was a divergence of knowledge of the eligibility of the three-dose HPV vaccine across the medical professions. This difference of knowledge was also significant when a sub-analysis was undertaken by gender, <8 years and ≥8 years of work experience, and workplace. A poor mean attitude score was yielded, with nurses and general practitioners expressing a higher level of concern about subsequent promiscuity following HPV vaccine uptake. HCWs were unanimous about their perception of safety as a major public concern. HCWs from private practices were the most concerned about the safety of the HPV vaccine in HIV-infected girls.

There is an urgent need to bridge knowledge and divergence and to foster an attitude favourable to promoting HPV uptake. Given nurses' strategic position in public health, it is imperative that cervical cancer prevention becomes a significant component of continuing nurse education. The findings highlight the need to develop effective and possibly separate interventions for different medical professions, and possibly by gender, work practice and < 8 years and ≥8 years of work. An emphasis should be placed on how the HPV vaccine should be a crucial component of cervical cancer management in HPV naïve girls, HIV negative or HIV -infected girls.

Abbreviations
HPV: Human Papilloma Virus
NGO: Non-Governmental Organization
IREC: Institutional Research Ethics Committee

Declarations
Ethics Approval and Consent to Participate:
Ethics approval and consent to participate was sought and obtained from Moi University School of Medicine/Moi Teaching and Referral Hospital Ethical Committee (IREC). A self-administered questionnaire was given to the participants after a signed consent. Information collected was kept confidential by using numbers and codes, especially the data on knowledge, attitude, and acceptability of the HPV vaccine. Furthermore, informed consent was obtained from all individuals. Ethical approval was obtained from the Ethics Committee of the Moi Teaching and Referral Hospital/Moi University School of Medicine (IREC). FAN: IREC 1428

Consent for Publication
Not Applicable

Availability of Data and Materials:
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests:
The authors declares that they have no competing interests

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Authors' Contributions:
HM designed, collected data, analyzed and interpreted the data and wrote the manuscript. SM analyzed and interpreted the data. OO Analyzed data and contributed to writing the manuscript. JO analyzed and interpreted the data DV analyzed and interpreted data. All authors read and approved the final manuscript.

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Author's Information: This paper explores Kenya's healthcare provider knowledge, attitudes and acceptability surrounding the HPV vaccine which was approved in 2007. There is little or no information about HPV vaccine acceptability among HCW working in Kenya, unlike in industrialized settings. The research is innovative as it sets out to assess differences in knowledge according to different medical professions, gender, years of work, and an outpatient location in order to make policy recommendations for HPV education interventions.

References
1. Bosch, N. Munoz and K.V. Shah, Prevalence of penile human papillomavirus DNA ... and cervical cancer in female partners, N Engl J Med 346 (2002), 1105–1112. ... F.X
2. Trottier H, Franco EL Human papillomavirus and cervical cancer: burden of illness and basis for prevention. Am J Manag Care. 2006 Dec; 12 (17 Suppl): S462-72.
3. Sellors JW et al (2000) Prevalence and predictors of human papillomavirus infection in women in Ontario, Canada. Survey of HPV in Ontario Women (SHOW) Group. CMAJ 163:503.
4. K.M. Stone, K.L. Karem, M.R. Sternberg, G.M. McQuillan, A.D. Poon, E.R. Unger, et al. Seroprevalence of human papillomavirus type 16 infection in the United States. J Infect Dis, 186 (10) (2002), pp. 1396–140
5. Kahn et al. The Elevated 10-Year Risk of Cervical Precancer and Cancer in Women

With Human Papillomavirus (HPV) Type 16 or 18 and the Possible Utility of Type-Specific HPV Testing in Clinical Practice. JNCI J Natl Cancer Inst (20 July 2005) 97 (14): 1072-1079. doi: 10.1093/jnci/dji187

6. Kenya Ministry of Public Health and Sanitation and Ministry of Medical Services (2009). Draft National Cancer Control Strategy 2010-2015. Nairobi. http://www.ipcrc.net/pdfs/intl_programs/Final-Draft-of-the-Kenya-Cancer-Control-Strategy-April-2011.pdf .Page 13.
7. World Health Organization. Non Communicable Diseases: An overview of Africa's New Silent Killers. Available from: http://www.afro.who.int/en/kenya/kenya-publications/1236-non-communicable-diseases-an-overview-of-africas-new-silent-killers.html.
8. Baldwin W, Amato L. Fact Sheet: Global Burden of Non-communicable Diseases. Available from: http://www.prb.org/Publications/Datasheets/2012/world-population-data-sheet/fact-sheet-ncds.aspx.
9. Williams, Michelle A., Patrick R, Kenya, J.K.G. Mati and David B. Thomas (1994). "Risk factors for invasive cervical cancer in Kenyan women." International Journal of Epidemiology 23: 906-912.
10. Gatune JW, Nyamongo IK (2005) An ethnographic study of cervical cancer among women in rural Kenya: is there a folk causal model? Int J Gynecol Cancer 15: 1049–1059.
11. Huchko, Megan J., Elizabeth A. Bukusi and Craig R. Cohen (2011). "Building capacity for cervical cancer screening in outpatient HIV clinics in the Nyanza province of western Kenya" International Journal of Gynecology and Obstetrics.
12. McKenzie, Kevin P. McKenzie, Robyn K. Rogers, Julia W. Njoroge, Grace John-Stewart, Barbra A. Richardson, Nelly R. Mugo, Hugo De Vuyst, Ritesh N. Pamnani, Farzana S. Rana, Danson Warui and Michael H. Chung (2011). "Cervical Squamous Intraepithelial Lesions Among HIV-Positive Women on Antiretroviral Therapy in Kenya" Current HIVResearch 9: 180-185.
13. Gerend MA, Barley J.Human papillomavirus vaccine acceptability among young adult men. Sex Transm Dis. 2009 Jan; 36(1):58-62.
14. Medical News Today, (2005). "Kenya's Pharmacy and Poison Board Approves Marketing GlaxoSmithKline's HPV Vaccine Cervarix," September 5.
15. Zimet, 2005. Improving adolescent health: focus on HPV vaccine acceptance. J Adolesc Health. 2005 Dec;37(6 Suppl): S17-23
16. Dinh TA, Rosenthal SL, Doan ED, Trang T, Pham VH, Tran BD, Tran VD, Phan GA, Chu HK, Breitkopf CR. Attitudes of mothers in Da Nang, Vietnam toward a human papillomavirus vaccine. J Adolesc Health. 2007; 40:559–563.
17. Glanz, K., Rimer, B.K. and Lewis, F.M. Health Behavior and Health Education: Theory, Research, and Practice, 3rd edn. San Francisco CA: : Jossey-Bass; 2002
18. Makwe CC, Anorlu RI (2011) Knowledge of and attitude toward human papillomavirus infection and vaccines among female nurses at a tertiary hospital in Nigeria. 3: 313–317
19. Brewer NT, Fazekas KI. Predictors of HPV vaccine acceptability: A theory-informed, systematic review.Prev Med 2007; 45:107-14.
20. Scarinci IC, Garcés-Palacio IC, Partridge EE. An examination of acceptability of HPV vaccination among African American women and Latina immigrants. J Women's Health (Larchmt) 2007;16:1224-33
21. M Kojic, M Kang, MS Cespedes, S Cu-Uvin, et al. Immunogenicity and Safety of a Quadrivalent Human Papillomavirus Vaccine in HIV-1-Infected Women. *Clinical Infectious Diseases*. April 14, 2014
22. Henninger J. Human papillomavirus and papillomavirus vaccines: knowledge, attitudes, and intentions of general practitioners and practice nurses in Christchurch. J Prim Health Care. 2009 - CSIRO; 1(4):278–285.
23. Kahn JA, Rosenthal SL, Hamann T, Bernstein DI. Attitudes about human papillomavirus vaccine in young women. Int J STD AIDS. 2003;14(5):300–306

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Healthcare Professionals' Perception of Mobile Learning in Singapore

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Abstract
Mobile phones have great efficiency, are affordable and have greater connectivity. This potential can be utilized to promote learning with deeper understanding and excitement that allows personal development. Medical educators are now embracing the use of technology to equip medical students with necessary tools to succeed as doctors. This study explores the attitudes of healthcare professionals towards the use of mobile technology to find out the value of promoting mobile learning in Singapore. Healthcare professionals, consisting of doctors, nurses, and allied health professionals, were administered a questionnaire through Google Forms. The results show that the majority of the respondents utilized their mobile devices for a variety of internet-related activities. The general perception of the use of mobile learning was accepted amongst the respondents but less so for formal professional education, especially in the clinical setting.

Key Words
Mobile Learning; Technology; Health Professionals

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Introduction

Mobile learning has become popular, with the ubiquitous nature of smartphones and tablets. The devices have become more efficient, convenient and affordable, and they have greater connectivity.[1] With mobile technology Learning can happen anytime, anywhere, and just-in-time to maximise its effectiveness.[3] Mobile technology gives education a more exciting shape, ensures broader access to higher education, and allows personal development and cultural enrichment.[4]

Singapore has a high percentage of smartphone users per capita. It reached 4.65 million in 2020, which translates to 90 percent of its total population. Singapore has a mobile penetration rate of 159.1 percent, making it very attractive for mobile companies, with Apple being the market leader with approximately a third of the Singapore market share. There are now 11 telecommunication companies in the country, with Singtel, M1, and StarHub being the major players. Data is affordable, with island-wide coverage, and many companies offer lower cost and off-contract plans. The government has plans to operate 5G networks island-wide by 2021.[5] Singaporeans are now using their smartphones for calling and messaging, social networking, work and school-related activities, and online transactions.

Technologies have transformed higher education institutions into centres of collaborative inquiry and self-directed learning under the guidance of a facilitator.[4] Teaching practices in higher education are more learner-centred, and the teacher's role has shifted from a source of knowledge to facilitator. It has accelerated the need for a re-evaluation of the role of teaching and instruction and strategically planned faculty support.[6] Learning and conceptual understanding improve when learners assume responsibility for their learning by being actively involved in the learning process. This change in pedagogy has increased learner motivation and overall learner satisfaction.[7] Medical educators are also embracing the use of technology to equip medical students with the necessary tools to succeed as doctors. The Lee Kong Chian School of Medicine in Singapore has been providing their medical students with iPads, loaded with course content that has been developed by Imperial College, London, to prepare them for their team-based learning sessions.[8] During the Covid pandemic, medical education had to rely heavily on technology, with face-to-face teaching and clinical postings suspended.

Mobile learning using portable electronic devices is transforming the healthcare environment. Health professionals, especially trainees and medical students in the clinical years, use them for

convenience and to improve efficiency in their work, as they can provide instant learning experience at the point of care. These devices allow easy access to a wide variety of educational resources to support learning in the clinical environment,[10,11] which are verified, evidence-based information, and up-to-date enhanced knowledge that will shape their clinical decisions. However, they will have to follow existing guidelines and respect patients' acceptance and privacy when they decide to use their mobile devices in the clinical setting.[12]

Recent studies have shown the effectiveness of using mobile technology in healthcare. Lall and colleagues indicated that mobile learning can play a significant role in medical and nursing education as learners are familiar with their devices and can personalise them towards their learning needs.[13] Yap underlined that, with the growing use of smartphones, mobile apps could potentially be used as a platform to train pharmacy students for clinical practice [14] Chang *et al*. showed that resident physicians in resource-limited settings effectively used smartphones loaded with point-of-care tools for accessing medical information at the bedside and for self-directed learning.[15] In another review, O'Donovan *et al*. showed that mobile learning was a promising tool for educating and training community healthcare professionals in developing countries.[16]

The literature has identified the following key factors for the success of mobile learning:[17]

- The pedagogical integration of the technology into the course assessment.
- Teacher modelling of the pedagogical use of the tools.
- The need for regular formative feedback from teachers to learners.

The appropriate choice of mobile devices and software to support the pedagogical model underlying the course.

Lundin and colleagues suggested that universities integrate learners' own mobile technology which they use daily to create social interactions, a collaboration between peers, sharing experiences, and improvements in knowledge into their educational activities.[18] Mobile learning using technology that is widely available and familiar facilitates its acceptance by learners. Research has shown that, in Singapore, mobile learning in higher education, combined with social media and other educational tools that have been effectively integrated into their course design, has greatly enriched learners' experience and produced valuable learning outcomes.[19,20]

Mobile learning and blended learning allow for the combination of hands-on, skills-based training, as well as self-directed, knowledge-based learning. Tudor Car and colleagues reported that mobile learning may promote better engagement of learners and enable easy, on-the-go access to education.[21] The use of mobile learning in schools in Singapore is well researched and documented.[22] Despite a growing trend where education authorities mandate teachers to apply modern digital technology in teaching programmes, research has shown that teachers may not be compliant unless they can see the value of mobile technology and are confident and competent to use them effectively in their teaching practice. Teacher educators should inculcate positive attitudes towards technology in their training programmes and encourage pre-service teachers to harness them in their classrooms.[23] Overall, mobile learning has much to offer, especially when learning content is designed to work on any device.[24]

The current body of knowledge provides the conceptual framework that mobile learning is effective and an efficient means of delivering health professional education. In order to maximise the role of mobile learning in health professional education, we will need to understand and overcome the gaps in knowledge that support or impede its implementation and use. This research will determine the perception, acceptance, and competencies of teachers and learners and the critical success factors of mobile learning in health professional education in Singapore.

Aim

The aim of this study is to explore the attitudes of healthcare professionals towards the use of mobile technology in their graduate and post-graduate education in Singapore. The results of this survey help to guide the planning of mobile learning in health professional education in Singapore.

Methods

Participants

Healthcare professionals, consisting of doctors, nurses, and allied health professionals, at the Khoo Teck Puat Hospital, a regional public hospital in Singapore, were invited to participate in the study from 1 September 2015 to 31 July 2016. One hundred and thirty-three participants were recruited through a purposive and convenience sampling approach, including snowball sampling. Informed consent was obtained from all participants. They were informed that their contributions in the study were entirely voluntary and their responses were confidential. The questionnaire was administered online using Google Forms.

Ethics approval was obtained from the hospital's Ethics Review Board.

Questionnaire Development

The items included in the survey were adopted from prior literature but adapted to the context of mobile learning in healthcare professional education. From our literature review, there was no prior validated instrument to evaluate the perception amongst healthcare professionals on mobile learning.

A test was conducted to assess the content validity of the initial questionnaire. A total of 30 health professional students were invited to do a pilot questionnaire, and their feedback was solicited. The questionnaire was refined based on their comments, sentences were rephrased, and ambiguous questions were eliminated.

The final version of the questionnaire comprised 26 items. The first four items represented demographic data, and 21 items pertained to themes on mobile device use and learning. The themes were 1) the utility of mobile device (two questions), 2) participation in learning with the use of a mobile device (four questions), 3) ease of learning with the use of a mobile device (four questions), 4) knowledge of online learning (three questions), 5) professional use of a mobile device (two questions) 6) assessment of learning through mobile devices (three questions), and 7) future use of mobile learning (three questions). The final question was an optional, open-ended question to poll respondents.

Questions under themes 1) and 7) were multiple-choice questions. Questions under themes 2) to 6) were a five-point Likert scale, with "1" = strongly disagree, "2" = disagree, "3" = neither agree nor disagree, "4" = agree, and "5" = strongly agree.

Statistical Analysis

Descriptive analyses were done to report the demographic information and frequencies of variables. The relationships between demographics and the questions were examined using independent *t*-tests and one-way analysis of variance (ANOVA) tests. Cronbach's alpha reliability statistics were performed for questions within the themes. Stata v16 was used for the data analysis, and statistical significance was set at 0.05.

Results

The mean age of the 133 respondents was 33.6 ± years 9.9 (range 21 – 74). There were 97 females (72.9%), and 70 (52.6%) respondents were nurses. The majority of the respondents did ward-based work. The breakdown of the professions and the locations where respondents worked can be seen in Table 1.

Figure 1 shows that the majority of the respondents utilised their mobile devices for a variety of internet -related activities, such as accessing the internet (90.9%), looking up information (85.0%), accessing a social networking site (80.5%), and sending an email (77.4%). Comparatively, Figure 2 shows that a lower proportion of respondents felt that learners used their mobile devices to look up information (76.7%), engage in social networking (69.2%), and communicate with peers and teachers (67.7%).

Table 1: Demographic information of participants

Profession	Medical (n=30, 23%)
	Allied Health (n=27, 20%)
	Nursing (n=70, 53%)
	Educator (n=6, 4%)
Workplace (more than one place)	Ward (n=85)
	Clinic (n=34)
	Theatre (n=20)
	Field (n=15)
	Classroom (n=9)

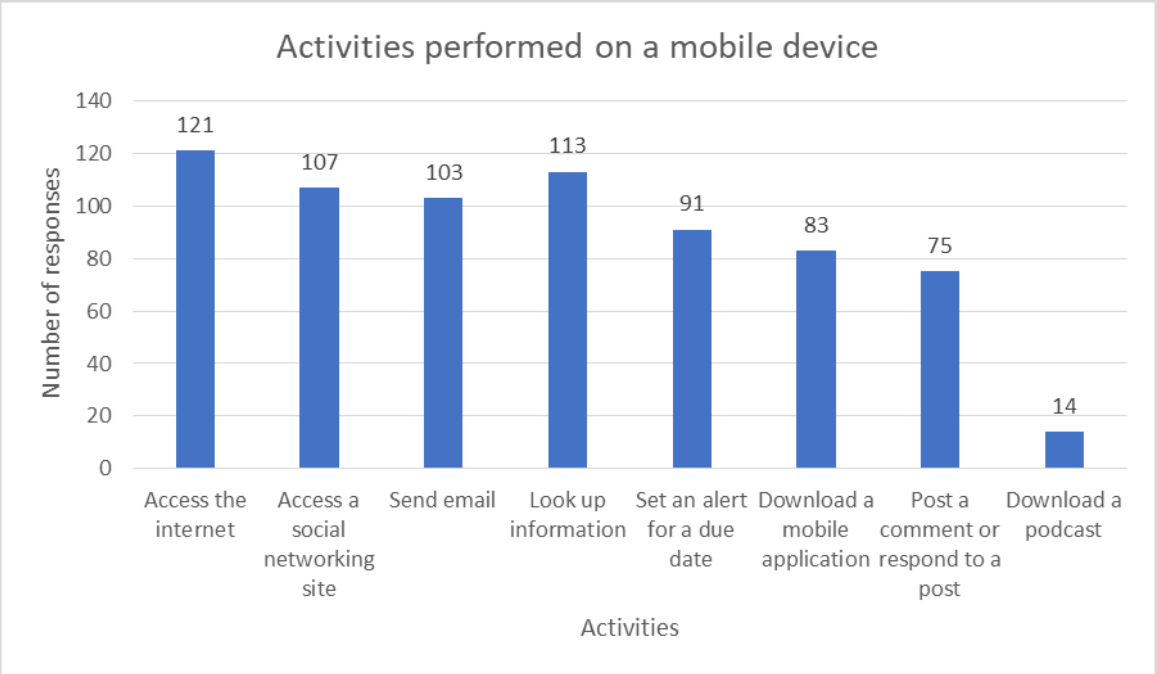

Figure 1: Activities participants performed on a mobile device in the past week

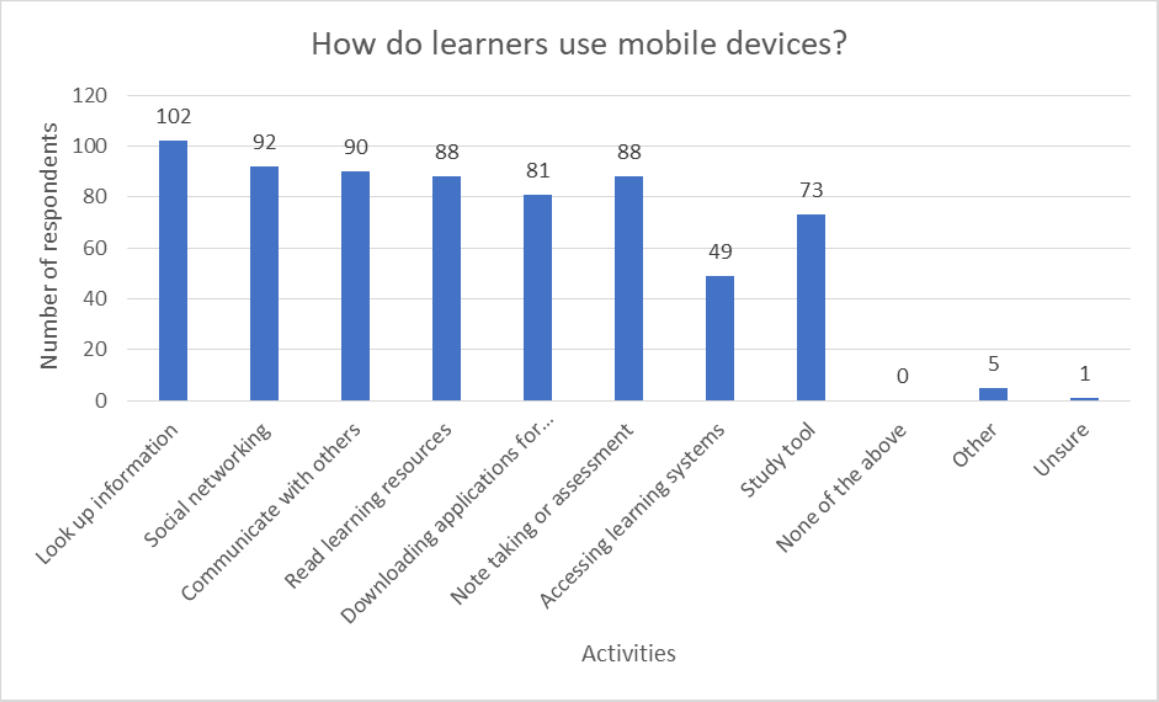

Figure 2: Activities performed by learners on their mobile devices

All dimensions received a majority average percent positive dimension score. The ease of learning on mobile devices ranked the highest (75.7%), followed by knowledge of mobile learning (71.7%), assessment of learning through mobile devices (71.5%), professional usage of mobile learning (66.9%), and, finally, participation in learning with the use of mobile devices ranking last (66.6%) (Table 2). There is strong internal consistency for the use of mobile devices for the various activities in mobile learning (Cronbach Alpha >0.8). However, the respondents' perception of mobile learning use in the clinical setting and health professional education had low internal consistency (Cronbach Alpha approx. 0.5). Therefore, the general perception of the use of mobile learning is acceptable amongst the respondents but less so for formal professional education, especially in the clinical setting.

Table 2: Participants' responses towards mobile learning (n=133)

Dimension	Positive response rate	Mean ± SD	Cronbach Alpha
Participation	**66.6%**		
7. Learners would be more likely to participate in teaching sessions if they could use their mobiles devices	61.7%	3.7 ± 0.95	
9. My healthcare learners would be more likely to participate in learning sessions if they could do so through their mobile devices	67.8%	3.8 ± 0.89	0.8834
10. Learners would be more engaged if they could communicate through their mobile devices	65.4%	3.8 ± 0.93	
15. Learners should be able to participate in online discussions from their mobile devices	71.4%	4.0 ± 0.86	
Ease of Learning	**75.7%**		
8. Learners would better manage learning time if they could access materials anytime, anywhere on their mobile devices	76.7%	4.1 ± 0.88	
12. Learners should be able to easily view educational resources, course content and practice skills on their mobile devices	85.7%	4.2 ± 0.81	0.8522
18. I believe using mobile applications for learning would benefit healthcare learners	76%	4.0 ± 0.86	
19. I think learners would be more motivated to learn if they could use mobile devices	64.2%	3.8 ± 0.93	
Knowledge	**71.7%**		
16. Learners know how to use a mobile application designed for health care learners	67.7%	3.9 ± 0.82	
20. I would like to learn more about incorporating mobile learning in my teaching practice	69.2%	4.0 ± 0.91	0.8090
22. I am aware of the potential of mobile technology for health profession education.	78.2%	4.0 ± 0.73	
Professional Use	**66.9%**		
11. Mobile learning should be incorporated into health care education	70.7%	3.9 ± 0.88	0.5803
21. I find it acceptable to use medically related mobile phone applications or internet sites when attending to patients.	63.1%	3.7 ± 1.01	
Assessment	**71.5%**		
13. Healthcare learners should be able to access Learning Management Systems (e.g. Blackboard) in a mobile format on their devices	76%	4.0 ± 0.88	
14. Learners should be able to perform assessment on their mobile devices	70.7%	3.9 ± 0.89	0.8193
17. It would be easier for learners to complete their assessment if they could use their mobile devices	67.7%	3.9 ± 0.79	

Regarding differences in responses by gender, the data showed statistically significant differences in most of the questions, with males scoring higher. The use of mobile devices for assessment in learning was statistically significant in all questions in the assessment dimension among all groups ($p<0.05$). Statistically significant differences from different professions were only seen in the areas pertaining to ease of access to resources, learning activities, and assessment. Overall, the younger respondents (under 30s group) had statistically significant lower mean scores in most questions except for some questions pertaining to participation, ease of learning, knowledge, and professional use.

Most respondents (80.8%) felt that mobile technology should be integrated into pre-clinical learning techniques as students would be able to learn at their own pace (Figure 3).

When asked about their attitudes towards incorporating mobile learning into their teaching (Question 25), 66.9% felt that they would be able to effectively incorporate mobile learning into their clinical practice, while 23.3% felt that they would be able to effectively incorporate mobile learning into their teaching. However, a lower proportion of respondents felt comfortable in designing mobile learning activities where, at best, only 60.9% felt comfortable using proper instructional techniques (Figure 4).

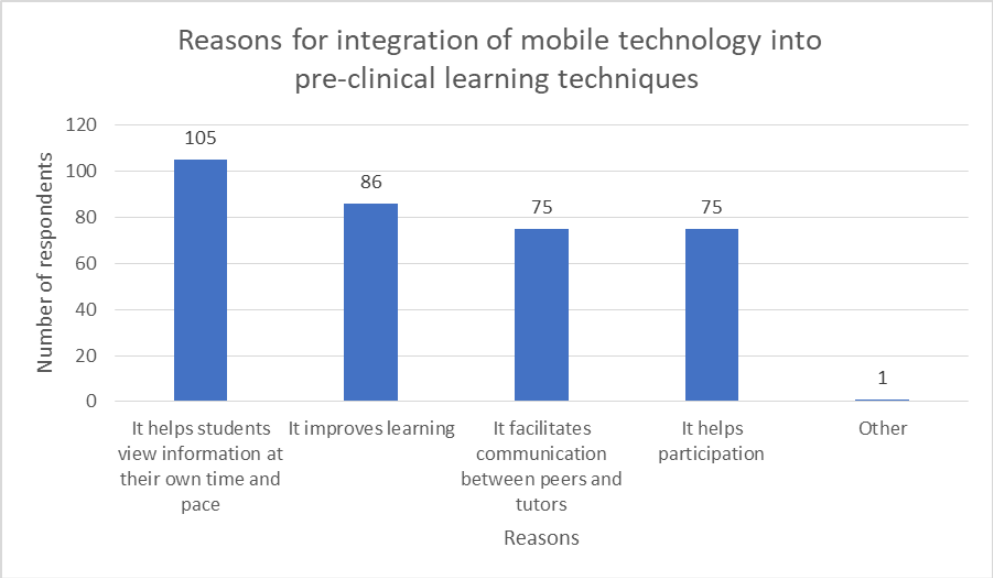

Figure 3: Reasons for integration of mobile technology into pre-clinical learning techniques

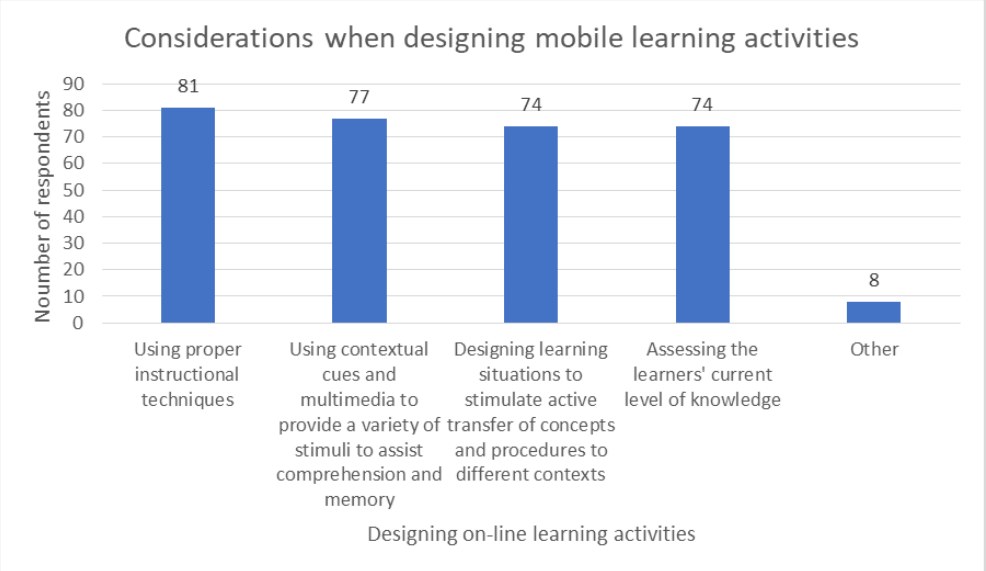

Figure 4: Considerations when designing mobile learning activities

Discussion

Mobile Technology Use for Learning

This is the first study conducted in Singapore with healthcare professionals about mobile technology use in education. Our data showed that healthcare professionals use mobile technology heavily for various activities, such as surfing the internet, social media use, email, searching information, digital reminders, using a mobile app, and interacting with others through a mobile device. In terms of using mobile technology for learning, learners are doing the following activities on mobile devices: looking up information, social networking, interacting with others, reading learning resources, downloading learning apps, and accessing learning systems and study aids.

The majority of participants are aware of the potential of mobile technology in healthcare education and perceive that mobile technology can improve learning and participation in learning. The majority think it is acceptable to use mobile devices when attending to patients and that they should be incorporated into clinical care. In addition, mobile technology should be used for assessment purposes.

Gender and Mobile Technology Use

Our data showed a significant discrepancy between female and male healthcare professionals in mobile learning. Overall, male healthcare professionals scored statistically higher average scores in advocating the use of mobile technology for learning (Q7, 15) and clinical care (Q11), estimating the advantages of mobile learning (Q8, 12, 18), learners' knowledge in mobile technology and learning (Q16, 20), and using mobile technology for assessment (Q13, 14, 17). The mobile gender gap has been well established and reported in international non-government organisations such as the *Role of Education and Skills in Bridging the Digital Gender Divide – Evidence from APEC Economies*, as well as the annual report for *the Mobile Gender Gap* by GSMA. For example, men in nearly all Asia-Pacific Economic Cooperation (APEC) economies used mobile technology more than women and have more skills and confidence in using digital technologies. Gender differences are observed in digital technology access, use and affordability, as well as socio-cultural norms. For our participants – healthcare professionals in Singapore - it is less of a problem for access, use, and affordability for these digital devices. We speculate that socio-cultural norms play a more prominent role. Men in general have been playing a more active role in digital transformation than women. In the Singapore healthcare system, all the Chief Information Technology Officers (CITO) have been males.

Age and Mobile Technology Use

Age has been an important factor in mobile technology use for learning. We categorised participants into younger or older than 30 years. A higher percentage of the older group (>30 years old) supports mobile technology use for learning when questioned about the use of mobile technology to participate in online teaching or discussion. A similar response was observed when questioned whether mobile technology made learning easily accessible and gave learners ownership. The older group with higher knowledge in using mobile technology in teaching advocates to integrate mobile technology for learning and assessment.

Profession and Mobile Learning

We surveyed doctors, nurses, allied health professionals and education administrators. A higher percentage of doctors favour mobile technology use in the following areas such as using mobile technology to deliver learning contents so learners can easily access this information, using mobile technology for learners to access online learning materials and to complete the assessments. For other areas, we did not observe differences among the different healthcare professions.

Conclusions

Similar to the other developed countries, mobile technology has been heavily used in healthcare professional education in Singapore. Most educators recognise the potential of mobile learning, despite the differences we observed in gender, age and profession. Future research should focus on identifying strategies to promote mobile learning among learners and faculty development efforts to get faculty members ready for planning and delivering mobile learning.

References

1. Traxler J, Vosloo S. Introduction: The prospects for mobile learning. PROSPECTS. 2014 Mar 1;44(1):13–28.
2. Al-Emran M, Elsherif HM, Shaalan K. Investigating attitudes towards the use of mobile learning in higher education. Comput Hum Behav. 2016 Mar;56:93–102.
3. Sha L, Looi C-K, Chen W, Zhang BH. Understanding mobile learning from the perspective of self-regulated learning. J Comput Assist Learn. 2012;28(4):366–78.
4. Burbules NC, Fan G, Repp P. Five trends of education and technology in a sustainable future. Geogr Sustain [Internet]. 2020 May 15 [cited 2020 Jul 31]; Available from: http://www.sciencedirect.com/science/article/pii/S2666683920300213

5. Müller J. Smartphone market in Singapore - Statistics and facts [Internet]. Statista; 2020 Jun [cited 2020 Aug 8]. Available from: https://www.statista.com/topics/5842/smartphones-in-singapore/
6. Pedro LFMG, Barbosa CMM de O, Santos CM das N. A critical review of mobile learning integration in formal educational contexts. Int J Educ Technol High Educ. 2018 Dec;15(1):10.
7. Wright GB. Student-Centered Learning in Higher Education. Int J Teach Learn High Educ. 2011;23(3):92–87.
8. Patel S, Burke-Gaffney A. The value of mobile tablet computers (iPads) in the undergraduate medical curriculum. Adv Med Educ Pract. 2018 Aug 10;9:567–70.
9. LKC School of Medicine F of M. Lee Kong Chian School of Medicine [Internet]. Imperial College London. [cited 2020 Aug 8]. Available from: http://www.imperial.ac.uk/medicine/partnership/education-collaboration/lee-kong-chian-school-of-medicine/
10. Norminathan A, Harrison A, Phelps M, Scott KM, Alexander S. Doctors' use of mobile devices in the clinical setting: a mixed methods study. Intern Med J. 2017;47(3):291–8.
11. Walsh K. The future of e-learning in healthcare professional education: some possible directions. Ann DellIstituto Super Sanità. 2014 Dec;50:309–10.
12. Scott KM, Norminathan A, Alexander S, Phelps M, Harrison A. Using mobile devices for learning in clinical settings: A mixed-methods study of medical student, physician and patient perspectives. Br J Educ Technol. 2017 Jan 1;48(1):176–90.
13. Lall P, Rees R, Law GCY, Dunleavy G, Cotič Ž, Car J. Influences on the Implementation of Mobile Learning for Medical and Nursing Education: Qualitative Systematic Review by the Digital Health Education Collaboration. J Med Internet Res. 2019;21(2):e12895.
14. Yap K. Usefulness of the Mobile Interactive Pharmacy Education Enhancement Resource (miPEER) Mobile Web-App as a Learning Tool for Electronic Health Records. Int J Clin Ski [Internet]. 2017 [cited 2020 Aug 7];11(6). Available from: http://www.ijocs.org/clinical-journal/usefulness-of-the-mobile-interactive-pharmacy-education-enhancement-resource-mipeer-mobile-webapp-as-a-learning-tool-for-electroni-12348.html
15. Chang AY, Ghose S, Littman-Quinn R, Anolik RB, Kyer A, Mazhani L, et al. Use of Mobile Learning by Resident Physicians in Botswana. Telemed J E Health. 2012 Jan;18(1):11–3.
16. O'Donovan J, Bersin A, O'Donovan C. The effectiveness of mobile health (mHealth) technologies to train healthcare professionals in developing countries: a review of the literature. BMJ Innov [Internet]. 2015 Jan 1 [cited 2020 Aug 7];1(1). Available from: https://innovations.bmj.com/content/1/1/33
17. Cochrane TD. Exploring mobile learning success factors. ALT-J Res Learn Technol. 2010 Jul;18(2):133–48.
18. Lundin J, Lymer G, Holmsquist LE, Rost M, Brown B. Integrating students' mobile technology in higher education. Int J Mob Learn Organ. 2010 Jan;4(1).
19. Menkhoff T, Bengtsson ML. Engaging students in higher education through mobile learning: lessons learnt in a Chinese entrepreneurship course. Educ Res Policy Pract. 2012 Oct 1;11(3):225–42.
20. Dunleavy G, Nikolaou CK, Nifakos S, Atun R, Law GCY, Car LT. Mobile Digital Education for Health Professions: Systematic Review and Meta-Analysis by the Digital Health Education Collaboration. J Med Internet Res. 2019;21(2):e12937.
21. Tudor Car L, Soong A, Kyaw BM, Chua KL, Low-Beer N, Majeed A. Health professions digital education on clinical practice guidelines: a systematic review by Digital Health Education collaboration. BMC Med. 2019 Jul 18;17(1):139.
22. So H-J, Kim I, Looi C-K. Seamless Mobile Learning: Possibilities and Challenges Arising from the Singapore Experience. Educ Technol Int. 2008;9(2):97–121.
23. Yeung AS, Taylor PG, Hui C, Lam-Chiang AC, Low E-L. Mandatory use of technology in teaching : who cares and so what? Br J Educ Technol. 2012;859–70.
24. Walsh K. Mobile Learning in Medical Education: Review. Ethiop J Health Sci. 2015 Oct;25(4):363–6.

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Echocardiography Results for COVID-19 Patients Admitted to Intensive Care

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Abstract
The coronavirus disease 2019 (COVID-19) pandemic has led to a significant number of critical care admissions worldwide, and the cardiac complications of severe disease are increasingly recognised. We reviewed the bedside transthoracic echocardiogram results of all patients admitted to our intensive care facility between March and May 2020.
All patients admitted to our intensive care unit who received an echocardiogram were included in the study. Scans were performed by experienced sonographers according to the guidelines of the British Society of Echocardiography. Demographic characteristics, ventilation settings during the echocardiogram, and patient outcomes, such as the need for mechanical ventilation and survival data, were also recorded.
Of the 40 patients included (mean age 58.1±9.3, 31 male), significant left ventricle (LV) dysfunction was only seen in 7.5% of patients (n=3). However, right ventricle (RV) dysfunction was highly prevalent and observed in 55.0% (n=22), with RV dilation seen in 33% (n=12). RV systolic pressures consistent with at least an intermediate probability of pulmonary hypertension were observed in 47.5% (n=19).
RV dysfunction and raised pulmonary pressures are common in COVID-19 patients in intensive care, with relative LV sparing. Intensivists managing coronavirus patients should obtain prompt echocardiograms to help identify right-sided dysfunction early and tailor management to protect the RV.

Key Words
COVID-19; Intensive Care Unit; RV Dysfunction

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Introduction

The pandemic caused by coronavirus disease 2019 (COVID-19) has led to a large number of critical care admissions worldwide. Whilst severe respiratory failure is by far the most common reason for admission to a critical care facility, as the pandemic has evolved, clinicians' understanding of the multisystemic nature of severe COVID-19 has become increasingly apparent.

The cardiac manifestations of COVID-19 are varied. Of hospitalised patients, a quarter have raised troponin assays on admission, with worse associated outcomes.[1] Early case reports detailed young patients developing a phenotype of illness similar to viral myocarditis, with preceding gastrointestinal symptoms followed by severe left sided ventricular failure and inotrop dependence. Other reported manifestations include ischaemia, arrythmias and, rarely, pericardial disease including tamponade.

However, the cardiac phenomena probably most familiar to intensive care physicians are the twin problems of raised pulmonary pressures and RV failure. Such is the prevalence amongst COVID-19 patients that recognition and treatment of these issue have evolved significantly. Echocardiography is now a routine investigation for those with critical care COVID-19. Treatments to reduce pulmonary vascular resistance such as sildenafil and prostanoids are now commonplace and the impact on the right ventricle (RV) from PEEP and vasopressors is increasing considered.

Despite this the prevalence and pattern of cardiac abnormalities in intensive care patients are not well documented. Studies in hospitalised COVID-19 patients have found that RV failure is common and associated with increased mortality.[2] Fewer studies have been conducted in the critical care setting. Given the greater severity of illness and use of mechanical ventilation, it is likely that abnormalities

are higher in this cohort of patients. One study of 52 intensive care patients found significant abnormalities during echocardiography.[3] However, given the small size of studies in this area, further research clarifying the extent and degree of cardiac dysfunction is warranted.

The aim of our study was to retrospectively review the echocardiogram results of patients admitted to Croydon's Intensive Care Unit during the first wave (between March and May 2020).

Methods

All patients admitted to the ICU (and its satellite units) with a positive SARS-CoV-2 polymerase chain reaction test (from a nasopharyngeal swab) between March 2020 and May 2020 were included in the study. Details of patients were obtained from the database used to inform the Intensive Care National Audit & Research Centre (ICNARC) audits. Patients were included in the study if they had a transthoracic echocardiogram (TTE) performed during their Intensive Care Unit (ICU) admission.

All TTEs were performed according to the British Society of Echocardiography (BSE) COVID-19 guidelines, with Level 1 scans performed. The scans were performed by a group of experienced BSE-accredited sonographers who were equipped with full personal protective equipment (PPE) including visors, FFP masks, gloves, and gowns. All scans were performed in the supine position. Left ventricular ejection fraction (LVEF) was calculated using the biplane Simpson's method. Echocardiographic assessment was performed according to the minimum data set for BSE scans.

In addition, electronic medical records were accessed and data extracted from them. Details obtained included basic demographic data, BMI, ethnicity, and comorbidities. Patient outcomes, such as the need for mechanical ventilation or filtration, as well as survival and discharge from the ICU at 28 days, were recorded. The hospital database was also accessed to explore whether patients had had previous echocardiograms prior to their admission. Ventilation details were also obtained from the records, where they were updated hourly.

The study was ethically approved by the Health Research Authority (REC: 21/HRA/2010), and informed consent was not considered necessary as the data had already been collected as part of patient care.

Statistics

Data were reported as mean (+-SD), unless nonparametric in which case they were expressed as median (+- IQR). Proportions were compared using the Chi-squared test (Fisher's exact), and values in two groups were compared using the Student's t-test, with statistical significance set as $p<0.05$ (two-sided value).

Results

Seventy-three patients were admitted to the unit over the observed period, and their clinical characteristics are summarised in Table 1. Of these patients, 40 received an echocardiogram during their intensive care admission (mean age 58.1±9.3, 31 male).

Patients who did not receive an echocardiogram during their admission were of similar age and BMI to those who did. Pre-existing comorbidities were common in both groups, with hypertension and obesity being the most prevalent. Significant differences were seen in the outcomes amongst the two groups, particularly in regards to mortality. Patients who did not receive an echocardiogram were less likely to survive ICU admission ($p=0.04$), and the time between ICU admission and death was significantly shorter ($p<0.0001$).

Table 1: *Characteristics of the First Wave COVID-19 Cohort*

Characteristic	Echo in ICU	No echo in ICU
Demographics		
Number (n=)	40	33
Age (years) (mean, (±SD)	58.1 (±9.3)	58.4 (±9.4)
BMI (kg/m^2)	30.1 (±5.2)	33.2 (±8.9)
Co-morbidities		
No co-morbidity	5 (12.5%)	2 (6.1%)
HTN	20 (50.0%)	19 (57.6%)
DM	13 (32.5%)	15 (45.5%)
Obesity	17 (42.5%)	18 (54.5%)
CKD	3 (7.5%)	0 (0%)
IHD	3 (7.5%)	0 (0%)
COPD	1 (2.5%)	0 (0%)
Outcomes		
Mechanically ventilated	39 (97.5%)	33 (100%)
Renal replacement therapy	31 (77.5%)	12 (36.4%)
Survived 28 days	16 (40.0%)	6 (18.2%)
Survived ICU admission	17 (42.5%)	6 (18.2%)
Days from ICU admission to death (median, ±IQR)	16.0 (±15.0)	5.0 (±4.0)
Discharged 28 days	6 (15.0%)	4 (12.1%)

BMI: Body Mass Index; HTN: Hypertension; CKD: Chronic Kidney Disease; IHD: Ischaemic Heart Disease; COPD: Chronic Obstructive Pulmonary Disease

Echocardiography data for the cohort are shown in Table 2. The majority of patients were invasively ventilated at the time of echocardiography (n=37, 92.5%).

Left ventricle

Overall, the majority of patients in the study did not have observable LV dysfunction. Significant LV dysfunction (severe or moderate) was seen in only three (7.5%) of our patients. Furthermore, LV regional wall motion abnormalities were rare and seen only in a single patient (2.5%).

Table 2: *Echocardiogram Results of COVID-19 Cohort*

Characteristic	Number	Percentage
Left ventricle		
LV impairment		
Normal (LVEF≥55%)	35	87.5%
Borderline (LVEF50-<55%)	2	5.0%
Moderate (LVEF35-≤50%)	2	5.0%
Severe (LVEF≤35%)	1	2.5%
Regional wall motion abnormalities	1	2.5%
Right ventricle		
RV dilation	12	30.0%
RV dysfunction	22	55.0%
TAPSE		
Mean TAPSE (±SD)	17.2 mm (±3.7)	
TAPSE <17mm	9	22.5%
RV systolic pressure (from TR max)		
Mean RSVP (±SD)	35.4 mmHg (±15.0)	
No TR jet	6	15.0%
Low RVSP/no TR jet (TRmax ≤ 2.8m/s or ≤31.4mmHg)	15	37.5%
Medium RVSP (TRmax 2.8-≤3.4m/s or 31.4-≤46.2 mmHg)	10	25%
High RVSP (TRmax >3.4m/s or >46.2mmHg)	9	22.5%
Other		
Pericardial effusion	1	2.5%

LV: Left Ventricle; RV: Right Ventricle; TAPSE: Tricuspid Annular Plane Excursion; TR: Tricuspid Regurgitation; RVSP: Right Ventricular Systolic Pressure

Right Ventricle

RV abnormalities were highly prevalent in the study. Approximately 30% (n=12) of patients were observed to have a dilated RV on their initial echocardiogram. RV dysfunction was observed over half of the cohort (n=22, 55.0%). The high prevalence of RV dysfunction was also illustrated by the Tricuspid Annular Plane Excursion (TAPSE) findings, an established marker of RV systolic function. The mean TAPSE was only 17.2mm, with values less than 17mm signifying RV impairment.

RV pressures were also elevated in the cohort. RV pressures were calculated using the modified Bernouli equation to relate the maximum velocity of the TR jet to the pressure gradient in the RV.[4] The gold standard diagnosis of pulmonary hypertension is via right-heart catheter, but echocardiography provides a useful noninvasive marker of the likelihood of raised pulmonary pressures.[5]

The mean RVSP was 35.4mmHg. A total of 47.5% of patients had estimated pressures of greater suggesting at least an intermediate risk of pulmonary

hypertension (TRmax >2.8m/s, RSVP >31.4mmHg). Nine of the 40 patients (22.5%) had observable RV pressures consistent with a high probability of pulmonary hypertension (TRmax >3.4m/s, RVSP >46.2mmHg).

Associations

RV dysfunction was not associated with lower survival rates (p=0.35) or reduced survival time on intensive care (p=0.49) in the study.

Similarly, elevated RVSPs were not associated with lower intensive care survival (>46.2mmHg, p=0.16; >31.4mmHg, p=0.99). No correlations were observed between RVSP values and PEEP (p=0.65, r=0.09), age (p=0.30, r=0.28) or BMI (p=0.58, r=0.10).

Discussion

The results of this simple study largely confirm what clinicians have already surmised from experienced gained working in critical care units caring for COVID-19 patients.

First, the burden of COVID-19 critical illness appears to be minimal on LV for the majority of patients. Our study illustrated that a relatively small proportion of patients had moderate to severe LV impairment as measured by ejection fraction. There are, of course, multiple caveats to this finding in our study. The concomitant use of vasopressors and inotropes was not measured in the study and, given that most patients would have been on at least noradrenaline infusions, this may have augmented the LV ejection fraction. It is worth pointing out this is a common issue experienced during critical care echocardiography, but it still certainly suggests significant LV impairment is only seen in a minority of patients.

Conversely, the impact on the RV is significant and highly prevalent. Features in keeping with elevated RV pressures were seen in almost half of our patients, with a quarter automatically having a high probability of pulmonary hypertension based on their RVSP values alone. The issues, however, with echocardiographic RV pressure measurement are myriad. RVSP measurement relies on obtaining the maximum velocity of the tricuspid regurgitant main jet (TRmax), and this value is subsequently squared and then multiplied, significantly enhancing the capacity for error. Furthermore, the association between TRmax and RVSP with free-flowing TR is poor. An absent TR jet does not even exclude raisedpressures.[4] Beyond this, the potential for confounders preventing the ascertainment of true RSVP values in critical care is huge. Varying driving pressures, positive-end expiratory pressures (PEEP), and multiagent vasopressor or inotrope use will undoubtedly influence RVSP. Furthermore, the mode of mechanical ventilation is likely to be a significant factor affecting RVSP, and there will be intrathoracic pressures differences between fully paralysed, mandatory-ventilated patients, and those with positive pressure-assisted spontaneous triggered breathing, even for the equivalent driving pressures and PEEPs.

However, while RVSP values obtained from echocardiography must be treated with caution, they still hold significant value in this population. The definitive investigation for pulmonary hypertension - pulmonary artery catheters (PAC) - have largely fallen out of favour in UK ICUs due to their high complication rate and a lack of evidence they improve patient care, even in units familiar them.[6] Notwithstanding the overall move away from PACs in critical care, their widespread use during the pandemic is clearly not feasible or desirable. Thus, for all its flaws, echocardiography remains the most useful modality in assessing the prevalence of pulmonary hypertension in the COVID-19 critical care cohort, and our study shows it highly prevalent.

Furthermore, this study also illustrates that RV dysfunction is also very common, seen in 55% of our patients. Whilst this represents a significant percentage of patients, the true proportion may in fact be higher. Echocardiograms were only performed in 40 of the 73 patients and, in large part, this was due to the fact that these patients died early in their admission before intensive care echocardiography was performed and spent many hours proned. Thus, it is probable the true burden of RV dysfunction may be somewhat higher.

It is worth highlighting that the number of patients from this cohort who did not have an echocardiogram is a significant limitation of this study. The retrospective nature of the project may have also led to a lack of consistency in the protocol used to obtain the images. An important additional point is that, as a single centre study with a disproportionately comorbid population, our findings may not be fully representative of ICU patients with COVID-19 nationwide. Overall, despite its limitations, this study has clearly demonstrated that RV dysfunction and pulmonary hypertension are extremely common features of COVID-19 critical illness, which is consistent with previous studies.[3]

In itself, recognition that around half of these patients have RV dysfunction and/or pulmonary hypertension is of huge clinical importance. A comprehensive discussion about management of right heart failure in critical care is beyond the

scope of this article, but what it does suggest is there is an important subset of COVID-19 patients for whom concern for the RV should be at the very centre of their care. On the most basic level, this should involve close monitoring of central venous pressure (CVP) trends, an accessible marker of RV preload. The process of PEEP titration should not solely focus on oxygenation and recruitment but consider the impact on RV, with a precipitous CVP rise in this context likely reflecting the right heart's inability to deal with this additional afterload. Furthermore, the choice of vasopressor agent should reflect a strategy designed to minimise any increase in pulmonary vascular resistance (PVR) whilst preserving perfusion pressures, with the early introduction of vasopressin, use of phosphodiesterase inhibitors and reasonable limits on noradrenaline where possible. It is crucial to recognise that progressive multi-organ dysfunction (rising lactates, oligo-anuria and hepatic dysfunction) in the context of a known failing RV may be far worsened by liberal fluid administration and increasing noradrenaline. Alternatively, aggressive fluid removal and reducing pulmonary pressures may provide a solution to this notorious 'cycle of death'. RV failure in critical illness is extremely challenging to treat but the path towards improving its treatment, and better patient outcomes most likely starts with prompt recognition of the problem.

References

1. Tersalvi G, Vicenzi M, Calabretta D, Biasco L, Pedrazzini G, Winterton D. Elevated troponin in patients with coronavirus disease 2019: possible mechanisms. Journal of cardiac failure. 2020 Jun 1;26(6):470-5.
2. Szekely Y, Lichter Y, Taieb P, Banai A, Hochstadt A, Merdler I, Gal Oz A, Rothschild E, Baruch G, Peri Y, Arbel Y. Spectrum of cardiac manifestations in COVID-19: a systematic echocardiographic study. Circulation. 2020 Jul 28;142(4):342-53.
3. Jain R, Salinas PD, Kroboth S, Kaminski A, Roemer S, Moreno AC, Khandheria BK. Comprehensive Echocardiographic Findings in Critically Ill COVID-19 Patients with or Without Prior Cardiac Disease. Journal of patient-centered research and reviews. 2021;8 (1):68.
4. Zaidi A, Knight DS, Augustine DX, Harkness A, Oxborough D, Pearce K, Ring L, Robinson S, Stout M, Willis J. Education Committee of the British Society of Echocardiography: Echocardiographic assessment of the right heart in adults: A practical guideline from the British Society of Echocardiography. Echo Res Pract. 2020; 7:G19-41.
5. Augustine DX, Coates-Bradshaw LD, Willis J, Harkness A, Ring L, Grapsa J, Coghlan G, Kaye N, Oxborough D, Robinson S, Sandoval J. Echocardiographic assessment of pulmonary hypertension: a guideline protocol from the British Society of Echocardiography. Echo research and practice. 2018 Sep 1;5(3):G11-24.
6. Harvey S, Harrison DA, Singer M, Ashcroft J, Jones CM, Elbourne D, Brampton W, Williams D, Young D, Rowan K. Assessment of the clinical effectiveness of pulmonary artery catheters in management of patients in intensive care (PAC-Man): a randomised controlled trial. The Lancet. 2005 Aug 6;366 (9484):472-7.

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Online Teaching vs. Face-to-Face Teaching: Which Is Better? Outcomes of A Survey of Medicine Trainees at Mid Yorkshire Hospitals NHS Trust

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Abstract
Objectives: To investigate the perceptions and preferences of medical trainees on the choice of formal learning modalities during the COVID pandemic in a district general hospital.
Methods: We performed a retrospective analysis in the form of a cross-sectional survey sent out to trainees of all grades working at Mid Yorkshire NHS Trust, United Kingdom in January 2022. The survey was carried out virtually using an online platform. Participants were given the option to rate each question regarding both learning modalities using a 5-point Likert scale (1=strongly disagree to 5=strongly agree).
Results: A total of 42 responses were included. Twenty-seven (64.3%) trainees preferred face-to-face teaching over online teaching. Thirty-two (76.2%) trainees felt motivated to attend face-to-face teaching, whilst only 26 (61.9%) trainees agreed same for online teaching. Almost double number of trainees (33; 78.6%) believed that face-to-face teaching is often stimulating, satisfying and enjoyable compared to online teaching.
Conclusion: This survey confirmed that face-to-face teaching emerged as the preferred choice of formal learning modality in our hospital. A hybrid model of teaching for postgraduate doctors would be ideal.

Key Words
Postgraduate; Doctors; Face-to-Face; Online; Teaching

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Introduction:

The COVID-19 pandemic has had a drastic influence on medical education with more emphasis on online education.[1] Online platforms such as Microsoft Teams and Zoom have replaced face-to-face teaching as formal learning modalities.

Ongoing regular teaching is vital for doctors in training continued professional development promotes high quality, evidence-based patient care and is an important feature of the GMC's Good Medical Practice.[2] During the pandemic there was a need for ongoing medical education as new treatments emerged for the SARS-CoV-2 virus and new guidelines were formulated. This was on top of their regular education and training requirements. However, due to social distancing and other preventive measures, classroom-style face-to-face teaching was disrupted[3] and was replaced by online teaching for the safety of trainee doctors throughout the NHS. There is data available on efficiency of online teaching at undergraduate level during the pandemic,[1,4] but that at postgraduate level for doctors is still emerging.

The purpose of this study was to establish the perceptions of doctors in training about their preferences between online and face-to-face teaching and a comparison of various aspects of both modalities from a trainee standpoint.

Material and Methods

This was a retrospective analysis in the form of an online cross-sectional survey sent out to trainees of all grades working at Mid Yorkshire Hospitals NHS Trust, United Kingdom in January 2022. The survey was carried out virtually using an online platform called Survey Planet. The survey was sent to trainee doctors via email and WhatsApp. Microsoft Excel 2016 was used to formulate tables and graphs.

The questionnaire had 19 items. DREEM[5] questionnaire was used to formulate some questions whereas in other questions participants were given the option to rate each question/ statement regarding both learning modalities using a scale of 1 to 5 (1=strongly disagree to 5=strongly agree).

The questions of motivation, stimulation, opportunities to ask questions, concentration and tendency to remember learning points were asked separately for each learning modality for comparison purposes.

Results

The inclusion criteria were trainees of all grades of internal medicine and its subspecialties. These trainees had experienced disruptions caused by the COVID-19 pandemic to their postgraduate education. The trainees of specialties other than medicine and its subspecialties were excluded from the survey.

The online survey was sent to a total of 60 doctors (see Figure 1) out of which 42 responded (response rate 70%). Out of the 42 responses, most were from the group of internal medicine trainees (n=13; 31%). Trust grade doctors and foundation trainees had similar numbers (n=11; 26%) and least responses were from higher specialty group (n=7; 17%).

Overall, a majority of the trainees favoured face-to-face teaching (see Figure 4) as a better teaching modality (n=27; 64.3%). However, an overwhelming majority favoured online teaching (see Figure 2.5) as an easier modality to attend (n=35; 83.33%).

Experiences of both modalities that were assessed in a Likert-scale from 1 to 5 (1 strongly disagree, 5 strongly agree) included motivation to attendance, stimulation, getting opportunities to ask questions, tendency to remember learning points in relevant clinical scenarios at work and concentration (see Tables 1 and 2).

Thirty-two (76.2%) trainees felt motivated to attend face-to-face teaching whilst only 26 (61.9%) trainees agreed the same for online teaching. Almost double the number of trainees (33; 78.6%) believed that face-to-face teaching is often stimulating compared to online teaching. The number of trainees who thought it was easier to ask questions in online teaching was higher (n=35; 83%) compared to face-to-face teaching. Almost similar number of trainees thought that in both online and face-to-face teaching they tend to remember learning points relevant to clinical scenarios (n=31 face-to-face; n=28 online). Similarly, when assessed for better concentration there was no clear preference with 30 trainees favouring online teaching and 27 favouring face-to-face teaching (see Figure 2).

One Likert-scale statement particular to online teaching assessed IT connectivity issues to which 16 trainees (38%) marked that they have had connectivity issues. The commonest online platform used was Microsoft Teams (see Figure 3) and use of multiple devices (n=24; 57%) for online access was the commonest amongst trainees.

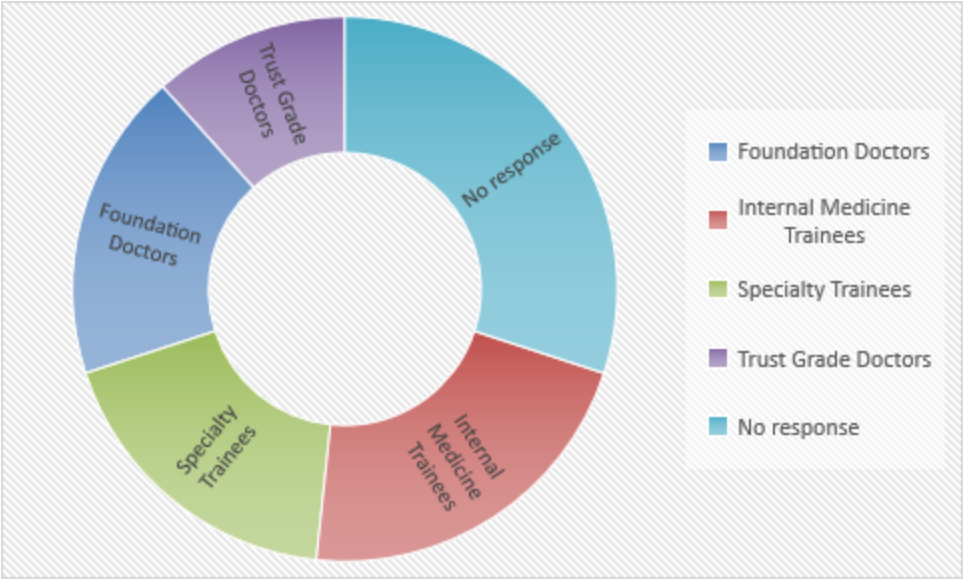

Figure 1 Various training grades of survey responders

Table 1: *Trainees' views towards online learning*

	Strongly disagree	Disagree	Neither	Agree	Strongly Agree
Motivation	1	5	10	20	6
Stimulating	0	5	20	14	3
Effective	4	4	9	27	1
Questions	1	2	4	29	6
Remember learning points	1	4	9	27	1

Table 2: *Trainees' views towards face-to-face learning*

	Strongly disagree	Disagree	Neither	Agree	Strongly Agree
Motivation	1	3	4	24	8
Stimulating	2	2	6	19	14
Effective	0	1	9	21	11
Questions	0	8	9	17	8
Remember learning points	0	1	9	21	11

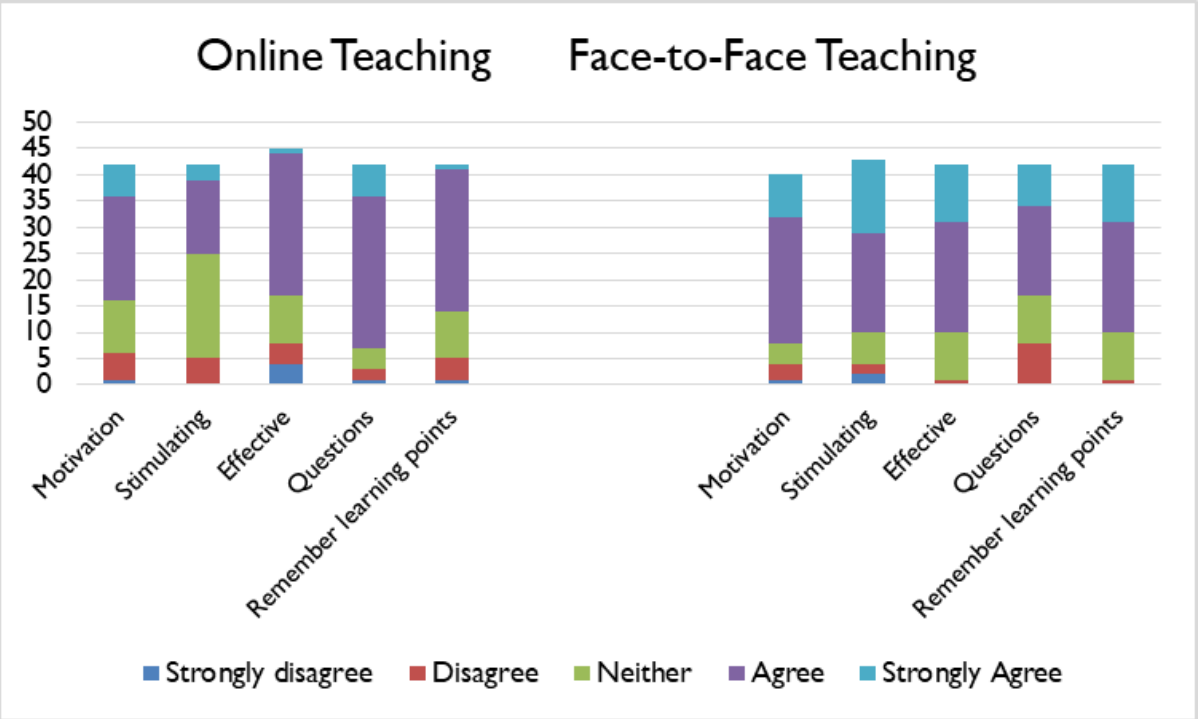

Figure 2: *Comparison of views around online and in-person teaching*

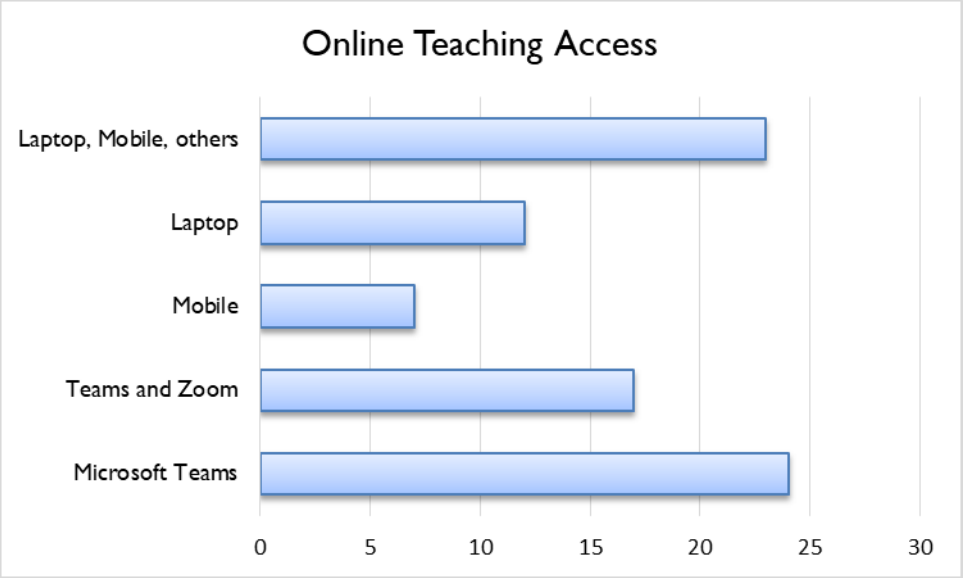

Figure 3: *Devices and applications used for online learning*

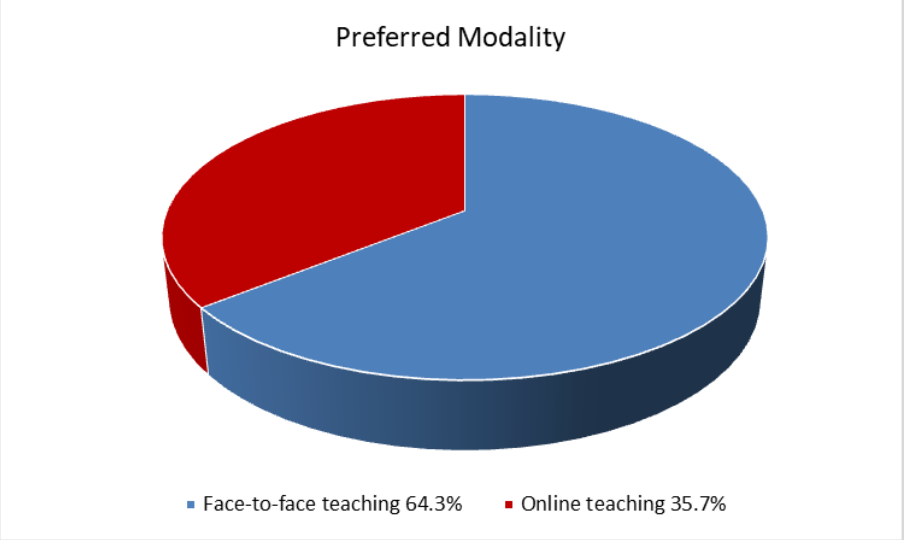

Figure 4: *Preferred teaching modality as per survey results*

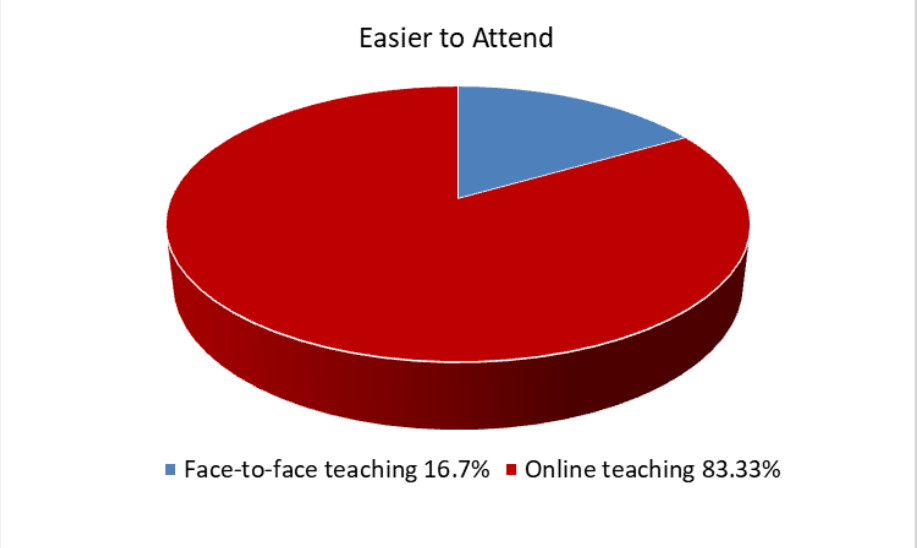

Figure 5: *Easier to attend teaching modality as per survey results*

Discussion

The COVID-19 pandemic has had a significant influence globally in many aspects of life. As of 8th December 2022, a total of 266,252,308 cases have been reported for the WHO European region, and 2,139,674 deaths have been recorded.[6] Doctors in training played a crucial role in providing front line services during the pandemic. Rotas were re-designed,[7] and many doctors, regardless of their specialties, were recruited to frontline fields, i.e. A&E, acute medicine and critical care[2]. The bulk of postgraduate medical education was either halted or severely reduced, and there was less emphasis on fulfilling training needs due to the high burden of service provision.

Our survey revealed that face-to-face teaching was the preferred modality by trainees. They found it more stimulating and interactive than online teaching. Perhaps this is because of a greater level of interaction between the trainer and the trainee, whether in a class or at the bedside. This therefore demands online teaching to be more interactive[8] as face-to-face teaching could not be implemented during the pandemic due to social distancing instructions.

Procedural learning is very hard to shift to online mode and this is particularly relevant to surgical specialties.[9] Therefore, trainees who took part in this survey coming from the background of procedure-oriented specialities had the experience of the COVID-19 pandemic negatively influencing their procedural training.

There are other areas where clinicians have been more inclined to in-person learning for enhancement of their skills. Out of many, management of complex clinical situations[10] such as end of life care, limited computer literacy[11] and more personal interaction[12] were identified as more compelling reasons why clinicians prefer face-to-face teaching.

Face-to-face CME and routine training offer an opportunity to meet and socialise with other colleagues who can be of variable grades and a respite from service pressures[13] and daily clinical routines.

The survey participants did view online teaching as a more flexible mode of learning. This is in line with the survey findings of other studies[14]. Learning at one's own pace at anytime,[15] rewinding a missed topic and access to content at time more suitable are a few of many reasons which add appeal to online learning. This however requires facilities at institutions to make online learning a more useful experience, such as recording of lectures, availability of high-speed internet,[16] availability of modern laptops, desktops etc to have better quality access and so on.

Online learning is a more cost effective teaching modality.[17] If trainees chose online teaching as their modality of choice for CME activities, this would save training boards and deaneries a substantial amount of money for reimbursement to trainees and speakers on expenses like travel, hotel stay, event fees etc. This money could then be spent on upgrading online training facilities.

The survey highlights the importance of incorporating the benefits of both teaching models and we suggest that a hybrid model of teaching for post graduate trainees and clinicians would be beneficial. Ideally this model will promote the positives in both face-to-face and online teaching and make attempts to overcome the challenges of both modalities.

This hybrid or blended model of learning utilizes various methods of both online and face-to-face which run hand in hand to provide quality learning to trainees. It encompasses teacher-led, simulation,[18] social media,[19] webinars,[20] and peer-to-peer techniques which offer flexibility and an enhanced professional development layout.

Mobile apps like Skype, Zoom[21] and WebX provide easy access to trainees for accessing lectures and CME content. Face-to-face teaching and courses can be arranged for practical skills learning, simulation and a more personal approach. A structured hybrid model, as per the requirements of postgraduate trainees, would hence be the way forward for a more holistic approach to learning with minimal challenges and obstacles.

There were limitations to our study. It was a retrospective analysis of trainees' perceptions of multiple and differing teaching events over the course of the pandemic. Their perceptions may have been adversely affected by individual positive or negative events or teacher competence. The survey took place in only one centre. Also, there were limited number of participants.

Conclusion

The results of our study reveal face-to-face teaching as the preferred teaching modality of postgraduate trainees. However, they did appreciate the online method as a more flexible one and there was no difference in the ability to concentrate or retain learning. There is a need to develop a hybrid model composed of both face-to-face and online teaching modalities for competence and professional development of post graduate trainee doctors and clinicians in the future.

References

1. Dost S, Hossain A, Shehab M, Abdelwahed A, Al-Nusair L. Perceptions of medical students towards online teaching during the COVID-19 pandemic: a national cross-sectional survey of 2721 UK medical students. BMJ open. 2020 Nov 1;10(11):e042378.
2. Available from: https://www.gmc-uk.org/-/media/documents/good-medical-practice---english-20200128_pdf-51527435.pdf
3. Nicola M, Alsafi Z, Sohrabi C, Kerwan A, Al-Jabir A, Iosifidis C, Agha M, Agha R. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. International journal of surgery. 2020 Jun 1;78:185-93.
4. Alsoufi A, Alsuyihili A, Msherghi A, Elhadi A, Atiyah H, Ashini A, Ashwieb A, Ghula M, Ben Hasan H, Abudabuos S, Alameen H. Impact of the COVID-19 pandemic on medical education: Medical students' knowledge, attitudes, and practices regarding electronic learning. PloS one. 2020 Nov 25;15(11):e0242905.
5. RoffS M, HardenRM AQ, AhmedAU D. Development and validation of the dundee ready education environment measure. Med Teach. 1997;19(4):295-9.
6. Available from: https://www.who.int/europe/emergencies/situations/covid-19
7. Roycroft M, Bhala NB, Brockbank S, O'Donoghue D, Goddard A, Verma AM. Rostering in a pandemic: Sustainability is key. Future Healthcare Journal. 2020 Oct;7(3):e54.
8. Reinholz M, French LE. Medical education and care in dermatology during the SARS-CoV2 pandemia: challenges and chances. Journal of the European academy of dermatology and venereology. 2020 May;34(5):e214-6.
9. Potts III JR. Residency and fellowship program accreditation: effects of the novel coronavirus (COVID-19) pandemic. Journal of the American College of Surgeons. 2020 Jun;230(6):1094.
10. Selman LE, Brighton LJ, Robinson V, George R, Khan SA, Burman R, Koffman J. Primary care physicians' educational needs and learning preferences in end of life care: a focus group study in the UK. BMC palliative care. 2017 Dec;16(1):1-9.
11. Vollmar HC, Rieger MA, Butzlaff ME, Ostermann T. General Practitioners' preferences and use of educational media: a German perspective. BMC health services research. 2009 Dec;9(1):1-1.
12. Yee M, Simpson-Young V, Paton R, Zuo Y. How do GPs want to learn in the digital era?. Australian family physician. 2014 Jun;43(6):399-402.
13. Mamary E, Charles P. Promoting self-directed learning for continuing medical education. Medical teacher. 2003 Jan 1;25(2):188-90.
14. Feldacker C, Jacob S, Chung MH, Nartker A, Kim HN. Experiences and perceptions of online continuing professional development among clinicians in sub-Saharan Africa. Human resources for health. 2017 Dec;15(1):1-8.
15. Schultze-Mosgau S, Zielinski T, Lochner J. Web-based, virtual course units as a didactic concept for medical teaching. Medical teacher. 2004 Jun 1;26(4):336-42.
16. Choi B, Jegatheeswaran L, Minocha A, Alhilani M, Nakhoul M, Mutengesa E. The impact of the COVID-19 pandemic on final year medical students in the United Kingdom: a national survey. BMC medical education. 2020 Dec;20 (1):1-1.
17. Bardesi H, Al-Mashaikhi A, Basahel A, Yamin M. COVID-19 compliant and cost effective teaching model for King Abdulaziz University. International Journal of Information Technology. 2021 Aug;13(4):1343-56.
18. Mak ST, Yuen HK. Oculoplastic surgery practice during the COVID-19 novel coronavirus pandemic: experience sharing from Hong Kong. Orbit. 2020 Jul 3;39(4):316-8.
19. Gallo G, Trompetto M. The effects of COVID-19 on academic activities and surgical education in Italy. Journal of Investigative Surgery. 2020 Aug 8;33(7):687-9.
20. Nadama HU, Tennyson M, Khajuria A. Evaluating the usefulness and utility of a webinar as a platform to educate students on a UK clinical academic programme. Journal of the Royal College of Physicians of Edinburgh. 2019 Dec;49(4):317-22.
21. Lewis EE, Taylor LJ, Hermsen JL, McCarthy DP, Fiedler AG. Cardiothoracic education in the time of COVID-19: how I teach it. The Annals of thoracic surgery. 2020 Aug 1;110(2):362-3.

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Letter to the Editor
Burnout - The Second Pandemic

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To whom it may concern,

I read with interest the article from Bandara *et al.* in Volume 26 of WJMER.[1] It was notable that issues with burnout, especially in the wake of the COVID-19 pandemic, are also evident in healthcare systems across the globe. This review was written in Canada and cited sources from Pakistan. A recent UK parliamentary report suggested that burnout in the National Health Service (NHS) is 'unacceptably high', with 44% of the workforce suffering from workplace-related stress, a rising figure compared with previous years.[2] The potential benefits of self-care are outlined well in the article, in addition to possible methods of implementation at medical school level. The author hopes this 'normalisation' of self care will allow future healthcare workers to better engage with services and establish self-care routines in their future careers. It does, however, remain to be seen how self-care strategies would be implemented in the current working population already suffering from burnout, especially within the financial and time constraints currently affecting the NHS. As alluded to in Bandara's article, a major method of addressing burnout is likely to be in addressing underlying causes, rather than in simply teaching healthcare workers to better deal with such stressors. It is my belief that ultimately this will have the most profound effect in reducing burnout. Despite the latest Omicron wave of COVID-19 not translating to ICU admissions or deaths as the Delta variant did,[3] the strain on the health service in the UK, and therefore its staff, remains high.[4,5] In addition to this, waiting lists at an all time high,[6,7] coupled with staff depletion, mean that the current work environment is likely to remain highly stressful for the foreseeable future. In my opinion, this would be best tackled with solutions aimed at better staff recruitment and retention.

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References

1. Establishing Self Care Practices Early in Medical and Health Education: A Reflection on Lessons Learnt from the Covid-19 Pandemic. Bandara et al, WJMER, Volume 26, Issue 1, 2021
2. Workforce burnout and resilience in the NHS and social care. HC22. 08/06/2021
3. Early assessment of the clinical severity of the SARS-CoV-2 omicron variant in South Africa: a data linkage study. Walter et al. Lancet 2022; 399: 437-46
4. Direct and Indirect Health Impacts of COVID-19 in England. 17/09/2021
5. https://www.bbc.co.uk/news/uk-northern-ireland-60508241
6. https://www.bbc.co.uk/news/uk-northern-ireland-56731572S waiting list hits 14 year record high of 4.7 million people. O'Dowd. BMJ 2021;373:n995

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